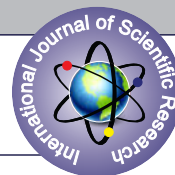


DRUG UTILIZATION PATTERN IN INDOOR PEDIATRIC PATIENTS OF PNEUMONIA IN A TERTIARY CARE TEACHING HOSPITAL IN SOUTHERN RAJASTHAN**Pharmacology**

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ABSTRACT

Background:- In medical practice drug utilization studies provides powerful, exploratory tools to ascertain role of drugs. Drug utilization research studies conducted in the inpatient settings are effective tools that help in evaluating the drug prescribing trends, efficiency, and cost-effectiveness of hospital formularies.

Aim:- To evaluate on drug utilization pattern of drug use in indoor pediatric patients of pneumonia using WHO recommended core drug use indicators. To analyse the data which can be utilized in future.

Material And Method:- This cross sectional, observational study is conducted in pediatric indoor department of BAL-CHIKITSALAYA of Maharana Bhoopal Hospital Udaipur, a tertiary care teaching hospital in southern Rajasthan for a period of 12 months (From January 2019 to December 2019) including all patients of pneumonia (both male and female) of age group from more than 1 month to 16 years admitted in the unit A of pediatric department.

Statistical Analysis:- This study data collected and entered in the Microsoft excel sheet and statistically analysed

Results:-

- 80.8% were less than five years of age, among which 51.6% were belongs to < 1 yr age group. Mean age of patients was 2.69 ± 4.15 yrs
- Male to female ratio was 2.16:1.
- Average number of drugs prescribed per inpatients was 7 ± 1
- 96.67% patients are treated by more than one antibiotic.
- Among various antibiotics Ceftriaxone is prescribed most frequently
- CEFTRIAZONE + AMIKACIN + AZITHROMYCIN combination is prescribed for most.
- Average number of antimicrobials prescribed was 3 ± 1 .
- Mean frequency to add or change the antibiotic was 29.2%.
- All the drugs prescribed by generic name and commonest route of administration of drug was oral followed by IV and then Inhalation.
- Average duration of hospital stay was 9 ± 3 days.

Conclusion:- Average number of drugs and antimicrobials prescribed per patient was higher than other studies. Rate of addition or change of antimicrobials was higher than other study. Almost Two third drugs were prescribed from WHO Essential Medicines List and NLEM. The treatment regimen implemented in most of the cases is without doing any culture sensitivity test which may lead to wide spread practice of irrational prescribing.

KEYWORDS

Paediatrics, Pneumonia, Prescribing pattern, Rational drug use, Drug utilization study.

INTRODUCTION

The World Health Organization (WHO) in 1977 defines drug utilization research as *"the marketing, distribution, prescription and use of drugs in a society, with special emphasis on the resulting medical, social and economic consequences"*.¹ In medical practice drug utilization studies provides powerful, exploratory tools to ascertain role of drugs. Such studies lay emphasis on the various determinants encompassing the prescribing, dispensing, administering, and related events, including medical as well as nonmedical aspects of drug utilization, its varied effects and consequences on drug use, beneficial or adverse^{2,3}.

Drug utilization research studies conducted in the inpatient settings are effective tools that help in evaluating the drug prescribing trends, efficiency, and cost-effectiveness of hospital formularies. There is always a variation in drug utilization among different countries and even among health institutions within a country and sometimes within the same institute at different point of time probably because of changing disease trends over a period of time^{4,5}.

Drug utilization studies, which evaluate and analyse the medical, social and economic outcomes of the drug therapy are more meaningful, and observe the prescribing attitude of physicians with the aim to provide drug rationally.⁶ Drug utilization research is an essential part of pharmacoepidemiology as it describes the extent, nature and determinants of drug exposure.⁷

Drug utilization data is required for analysing annual drug acquisition cost, drug supply to the subjects, drugs over or under utilization, drug pricing cost, cost consumption analysis and use. The anatomical therapeutic chemical (ATC) and defined daily dose (DDD)

methodologies are most important tool for measuring drug use, various drug therapy and comparing cost, consumption and improve the drug use practice in the health facility and region⁸.

Infants and children constitute a large proportion of the population in developing countries. They are especially vulnerable to contract illnesses and to the harmful effect of drugs due to differences in pharmacodynamics and pharmacokinetics⁹.

Acute respiratory infection, acute diarrhoea and viral fever are the common childhood illnesses accounting for the major proportion of paediatrics visits⁹. Current child health scenario indicates that pneumonia and diarrhoea continue to result in high mortality among children less than 5 years of age¹⁰. The Paediatric indoor department forms an important platform for conducting drug utilization studies as patients present with a wide range of diseases and the drug use is quite extensive, among which pneumonia is very much frequent and more serious than other diseases.¹¹

There are studies available in tertiary care teaching hospitals regarding drug utilization and prescription auditing in indoor paediatric patients related to some groups of drug or related to a particular disease. Given the higher incidences of pneumonia in paediatric age group and very few studies have been done to analyse drug utilization in indoor paediatric patients of pneumonia, especially none has been conducted in southern Rajasthan, the present study has been undertaken.¹²

MATERIAL AND METHODS**Study Design**

It is a cross sectional, observational study conducted in pediatric indoor department of BAL-CHIKITSALAYA of Maharana Bhoopal

Hospital Udaipur, for a period of 12 months (From January 2019 to December 2019).

Inclusion Criteria

All patients of pneumonia (both male and female) of age group from more than 1 month to 16 years, who are admitted in pediatric indoor department from 1.01.2019 to 31.12.2019.

Exclusion Criteria

1. Subjects with severe ailments those shifted to the ICU.
2. Those who are hospitalized and having taken treatment from other hospital before current admission.
3. Those who are having tubercular pneumonia, and other associated complaints like HIV, CHD etc.
4. Patients having other lower respiratory tract infections.

METHODOLOGY

After taking approval by the Institutional Ethics Committee of R.N.T. Medical College, Udaipur study started (No.-RNT/Stat./IEC/2019/844/27-06-2019). After taking consent from the patient, the socio-demographic data will be collected. A standard subject socio demographic and clinical features data collection proforma has been prepared and the characteristic like age, gender, occupation, income group subject IP/OP number will be recorded. Information regarding diagnosis, subject present/past medical history, treatment, any ADR, investigations, outcome, patients knowledge about drug treatment, self-medication will be collected from indoor admission ticket. The all enrolled patients are reviewed daily personally till completion of treatment to collect further information.

Statistical Analysis

This present study data collected and entered in the Microsoft excel sheet and statistically analysed.

RESULTS:-

During the study period, data of 120 patients were analysed as follows:

Age Distribution:

Most of the patients fall in the age group of <1 year with 61 (51.6%) patients followed by 1-5 years with 35 (29.2%) patients, followed by >5 years with 23 (19.2%) patients (Fig. 1).

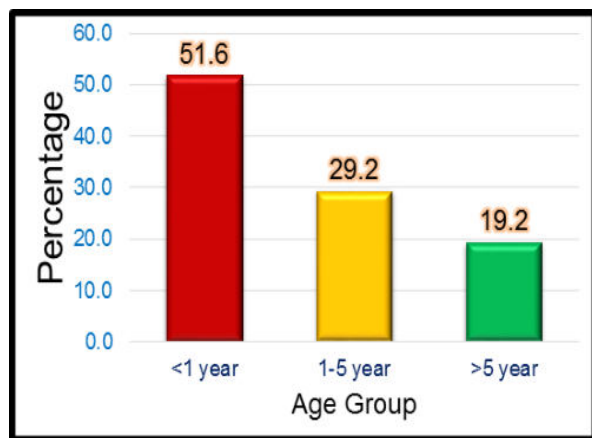


Fig. 1: Age Wise Distribution

Gender Wise Distribution

In this study 82 (68.3%) were male and 38 (31.7%) were female (Table 1).

Table 1: Gender Wise Distribution Of Patients

Gender	No.	Percentage	Male : Female
Male	82	68.3	2.16
Female	38	31.7	
Total	120	100.0	

Total Number Of Drugs Prescribed Per Encounter

The results of this study showed that most of the patients received multiple drug therapy as compared to a single drug therapy. Among those treated with multiple drug therapy, 7 drug combinations were more widely prescribed in 41 (34.2%) encounters followed by 8 drugs in 32 (26.7%) encounters, followed by 6 drugs in 28 (23.3%) encounters and so on. (Table 2).

Table 2: Total Number Of Drugs Prescribed Per Encounter

Total no. drugs per patient	No of patients	Percentage	Mean (±SD)
4	8	6.7	7±1
5	3	2.5	
6	28	23.3	
7	41	34.2	
8	32	26.7	
9	8	6.7	
Total	120	100.0	

Pattern Of Use Of Antibiotics

Antibiotics are the key drug in the management of pneumonia. In this study only 4 (3.33%) patients are found to be treated with only 1 antibiotic, rest 116 (96.67%) patients are treated by more than one antibiotic. (Table 3)

Table 3: Antibiotic Per Encounter

No. of antibiotics	No. of patients	Percentage
1 antibiotic	4	3.33
>1 antibiotic	116	96.67
Total	120	100.0

In patients receiving more than 1 antibiotics, Maximum 67 (55%) patients receives 3 antibiotics together, 24 (20%) receives 2 antibiotics, 21 (17.50%) patients receive 4 antibiotics, 4 (3.33) receives 1 & 5 antibiotics each. (Fig.2)

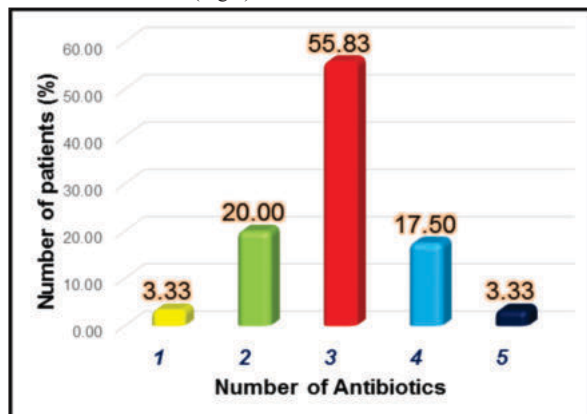


Fig. 2: Frequency Of Antibiotic Use

During the period of hospitalization and treatment, 85 (70.8%) patients respond well to the initial started antibiotics, but in 35 (29.2%) patients the response is not adequate and either escalation or change in antibiotic was done. (Figure 3)

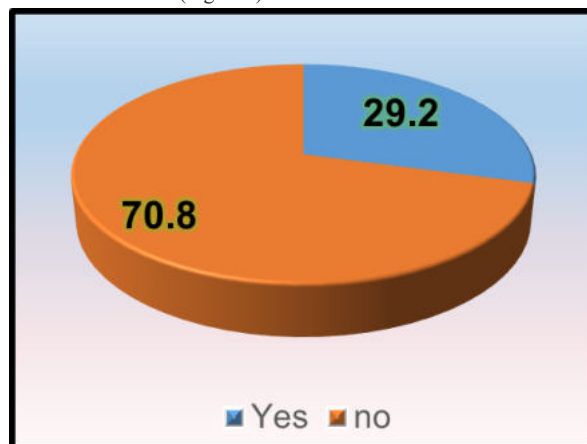


Fig. 3: Frequency Of Escalation Or Change Of Antimicrobials

Among various antibiotics Ceftriaxone is prescribed most frequently, 90 (25.2%) times, followed by Azithromycin 79 (22.1%), Amikacin 56 (15.7%), Vancomycin 45 (12.6%), Co-amoxiclav 43 (12.0%), Cefotaxime 18 (5%), Meropenem 13 (3.6%), Linezolid 5 (1.4%), Ceftazidime 4 (1.1%), Piperacilline+Tazobactam 4 (1.1%) times. (Table 4)

Table-4 Frequency Of Antibiotics Prescribed

Antibiotic	No.	%
CEFTRIAXONE	90	25.2
CEFOTAXIME	18	5.0
CEFTAZIDIME	4	1.1
AMIKACIN	56	15.7
CO-AMOXICLAV (IV)	43	12.0
VANCOMYCIN	45	12.6
PIPERACILINE+TAZOBACTEM	4	1.1
MEROPENEM	13	3.6
LINEZOLIDE	5	1.4
AZITHROMYCIN	79	22.1
Total	357	100.0

More than one antibiotics are used together. **CEFTRIAXONE + AMIKACIN + AZITHROMYCIN** is prescribed for highest 33(22.8%) times followed by **CEFTRIAXONE + CO-AMOXICLAV + AZITHROMYCIN** 16 (11.0), **CEFTRIAXONE + AMIKACIN** 15 (10.3), **VANCOMYCIN + MEROPENEM** 14 (9.7%) times. (Table 5)

Table No. 5: Frequency Of Antibiotics Prescribed Together

S. N.	Antibiotic combination	Numbers of encounter	%
1	CEFTRIAXONE + AMIKACIN	15	10.3
2	CEFTRIAXONE + AMIKACIN + AZITHROMYCIN	33	22.8
3	CEFTRIAXONE + CO-AMOXICLAV	9	6.2
4	CEFTRIAXONE + CO-AMOXICLAV + AZITHROMYCIN	16	11.0
5	CEFTRIAXONE + AMIKACIN + CO-AMOXICLAV	2	1.4
6	VANCOMYCIN + CO-AMOXICLAV + AZITHROMYCIN	4	2.8
7	CEFTRIAXONE + VANCOMYCIN	6	4.1
8	CEFTRIAXONE + VANCOMYCIN + AZITHROMYCIN	8	5.5
9	CEFTRIAXONE + AZITHROMYCIN	5	3.4
10	VANCOMYCIN + LINEZOLIDE + AZITHROMYCIN	4	2.8
11	VANCOMYCIN + MEROPENEM	14	9.7
12	CEFTAZIDIME + CO-AMOXICLAV (IV) + AZITHROMYCIN	4	2.8
13	VANCOMYCIN + PIPERACILINE+TAZOBACTEM + AZITHROMYCIN	4	2.8
14	CEFOTAXIME + AMIKACIN + AZITHROMYCIN	2	1.4
15	CEFOTAXIME + CO-AMOXICLAV + AZITHROMYCIN	4	2.8
16	CEFOTAXIME + VANCOMYCIN + AZITHROMYCIN	6	4.1
17	CEFOTAXIME + AZITHROMYCIN	3	2.1
18	CEFOTAXIME + AMIKACIN	6	4.1
	Total	145	100.0

Use of Oseltamivir

On the suspicion of Swine flu, 46 (38.3%) patients were given Oseltamivir. (Table 6)

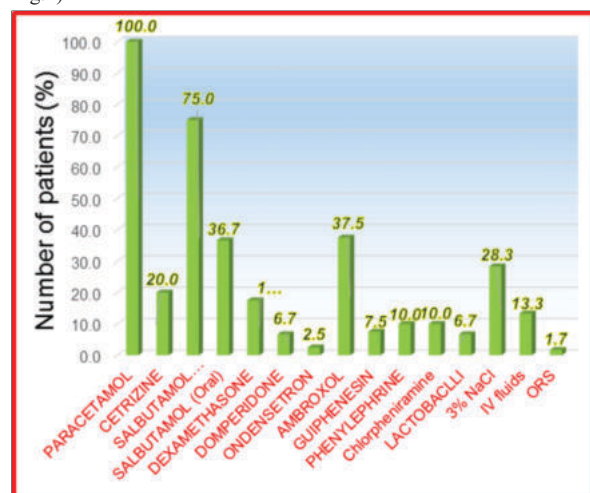
Table No. 6: Use Of Oseltamivir

S.N.	Use of oseltamivir	No of patients	Percentage
1	Yes	46	38.3
2	No	74	61.7
	Total	120	100.0

Concomitant Medication Prescribed

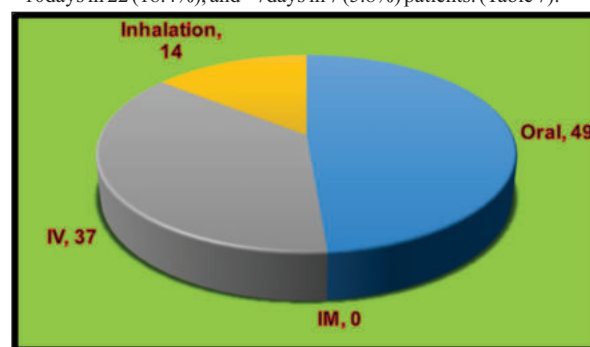
PARACETAMOL were the most commonly used concomitant medications, in all 120 (100%), encounters followed by **SALBUTAMOL (Nebulization)** in 90 (75%), **AMBROXOL** in 45 (37.5%), **SALBUTAMOL (Oral)** in 44 (36.7%), **3% NaCl (nebulization)** in 34(28.3%), **CETRIZINE** in 24 (20.0%), **DEXAMETHASONE** in 21(17.5%), **PHENYLEPHRINE & CHLORPHENIRAMINE** in 12 (10.00%), **GUIPHENESIN** in 9 (7.5%), **DOMPERIDONE** & **LACTOBACILLI** in 8 (6.7%), **ONDENSETRON** in 3 (2.5%) encounters.

IV fluids was used in 16 (13.3%) and **ORS** in 2 (1.7%) encounters. (Fig.4)

**Fig.4: Use Of Various Supportive Concomitant Drugs****Route And Duration Of Drug Treatment**

During this study, the oral route is used for 407 (49%) times, IV for 309 (37%), inhalation for 120 (14%) time, while no drug is given by IM route. (Fig.5)

The duration of treatment or hospital stay was 7-10 days in 91 (75.8%), >10days in 22 (18.4%), and <7days in 7 (5.8%) patients. (Table 7).

**Fig.5: Route Of Drug Administration****Table No. 7: Duration Of Hospital Stay**

Duration of hospital stay	No. of patients	Percentage	Mean (±SD)
< 7 days	7	5.8	9±3
7-10 days	91	75.8	
> 10 days	22	18.4	
Total	120	100	

ADR observed

Diarrhoea is reported in 8 (6.7%), skin rashes in 5 (4.2%), and red men syndrome like condition in 3 (2.5%) of total patients. (Table-8)

Table No.8: ADR Observed During Study

ADR	Number of patients	% (of total 120 patients)
Diarrhoea	8	6.7
Red man syndrome	3	2.5
skin rashes	5	4.2

Cost Analysis

In our institution all drugs prescribed are free supplied from the Government. So treatment causes no financial burden to the patient.

WHO Core Indicators

Various core indicators enumerated by WHO for Drug Utilization Studies are calculated from the collected data. (Table 9)

Table No.9: WHO Core Drug Use Indicators

Prescribing indicators	Result
1 Average number of drugs per prescription (Mean)	7 ±1

2	Average number of Antibiotics per prescription (Mean)	3±1
3	Percentage of prescription with an injection prescribed	100 %
4	Drugs prescribed from 21 st WHO Model List of Essential Medicines (2019)	17 (65.4%)
5	Drugs prescribed from NLEM 2015	17 (65.4%)
6	Percentage of drugs prescribed by generic name	100%
Facility indicators		
1	Availability of copy of essential drug list/ formulary	Yes
2	Availability of key drugs	Yes

DISCUSSION

As per pharmacoepidemiology in antibiotic utilization studies, our study has covered population from rural as well as urban areas, both genders, different socio economic groups and age groups.

The present study was conducted in indoor of Department of paediatric. Out of 120 patients enrolled in the study, majority of patients (n=97) (80.8%) were less than five years of age, among which 62 (51.6%) were belongs to < 1 yr age group. This may be due to increased susceptibility to infections during this period. This finding correlate closely with the study carried out by Sondarva Divyesh B et al, at Govt. medical college Rajkot¹³.

In the present study the mean age of patients was **2.69 ± 4.15** yrs (range 0.1-15 yrs). In the study carried out at BJ Medical College by Iyer GS, et al the mean age was 2.26 ± 2.42 years (range 1.5 months to 12 years), which is quite comparable to our study¹⁴.

In our study male to female ratio was 2.16:1. It is in agreement with international and national trends that point to pneumonia being more common in males¹⁵.

All the inpatients received minimum 4 drugs, while maximum 9 drugs were prescribed during hospital stay. During this period average number of drugs prescribed per inpatients was 7±1 in our study, which was 4.91 ± 1.40 in study conducted by Sondarva Divyesh B et al, at Govt. medical college Rajkot¹³.

Out of 120 patients only 4 (3.33%) patients are found to be treated with only 1 antibiotic, rest 116 (96.67%) patients are treated by more than one antibiotic.

In patients receiving more than 1 antibiotics, Maximum 67 (55%) patients receives 3 antibiotics together, 24 (20%) receives 2 antibiotics, 21 (17.50%) patients receive 4 antibiotics, 4 (3.33) patients receives 1 & 5 antibiotics each. In study conducted by Sondarva Divyesh B et al, at Govt. medical college Rajkot¹³, out of 255 patients 187 (73.33%) received one antimicrobial, 37 (14.5%) received two antimicrobial, 28 (10.98%) received three antimicrobial and 3 (1.17%) received four antimicrobial agents. In a study carried out at Canadian hospital by Anne Rowan-Legg et al patients with pneumonia, 40 (48.2%) received one antimicrobial, 33 (39.8%) received two, 8 (9.6%) received three and 2 (2.4%) received four antimicrobials (simultaneously or consecutively)¹⁶.

Among various antibiotics Ceftriaxone is prescribed most frequently, 90 (25.2%) times, followed by Azithromycin 79 (22.1%), Amikacin 56 (15.7%), Vancomycin 45 (12.6%), Co-amoxiclav 43 (12.0%), Cefotaxime 18 (5%), Meropenem 13 (3.6%), Linezolid 5 (1.4%), Ceftazidime 4 (1.1%), Piperacilline+Tazobactam 4 (1.1%) times.

CEFTRIAXONE + AMIKACIN + AZITHROMYCIN is prescribed for highest 33 (22.8%) times followed by **CEFTRIAXONE + CO-AMOXICLAV + AZITHROMYCIN** 16 (11.0), **CEFTRIAXONE + AMIKACIN** 15 (10.3), **VANCOMYCIN + MEROPENEM** 14 (9.7%) times. This finding is comparable to other studies reported from Kathmandu⁴² and Palestine⁴³ where either penicillin or a cephalosporin were the most frequently prescribed antibacterial for paediatric inpatients. One similar study showed where Co-amoxiclav was the most commonly prescribed followed by Amikacin and Ceftriaxone¹⁷. In a study done by Anne Rowan-Legg, et al at Canadian paediatric hospital Cephalosporin were commonly prescribed drug accounting around 96% of patients.¹⁸

In our study the average number of antimicrobials prescribed was 3±1.. The average number of antimicrobials prescribed per patient was 1.54

in a study carried out at Kanchanbagh, Hyderabad by L. Ramesh, et al¹⁹ and 1.4 in study conducted by Sondarva Divyesh B et al, at Govt. medical college Rajkot¹³.

Mean frequency to add or change the antibiotic in the current study was 29.2%. In a study conducted in April 2007 by Cristiane FR et al, frequency to add or change the antibiotic was 14.4%⁴⁷ and was 11.4% in study conducted by Sondarva Divyesh B et al, at Govt. medical college Rajkot¹³.

One interesting finding is that, on the suspicion of Swine flu, 46 (38.3%) patients were given Oseltamivir, though there is no specific investigation is done for this disease and the drug was given empirically in the earlier months of year (corresponding to winter season) and not given to all the patients and round the year.

In this study it was found that all the drugs prescribed by generic name, which is in accordance with the WHO recommendation.

In the present study the commonest route of administration of drug was oral followed by IV and then Inhalation.

The patients were hospitalized and administered medicines for an average duration of 9 ± 3 which is consistent with the proposed guidelines in the Nelsons textbook of essential paediatric. In study conducted by Sondarva Divyesh B et al this duration was 6.12 ± 1.03 days with a range of 1 day to 10 days. A study carried out by Iyer GS et al, the average duration of admission was 6.49 ± 3.23 days.²⁰ In another study carried by Zhange L et al, the mean length of hospital stay during the study period varying from 8.2 to 9.5 days.²¹

In our study the 17 (65.4%) drugs prescribed from 21st WHO Model List of Essential Medicines (2019) which show good practice habits of paediatrician. The same was also supported by the finding of 17 (65.4%) drugs prescribed from National list of essential medicines (NLEM-2015).

As seen in our study, antibacterial and respiratory medicines are often used indiscriminately. The diagnosis of causative agent and their sensitivity pattern was not evaluated and the antibacterial drug is given empirically. The higher frequencies of drug change or escalation than previous studies could also be the result of this. Education of the prescribers as well as the caregivers is imperative. Even as the heavy workload in Indian hospitals may be cited as a reason for the inability of doctors to communicate effectively with the parents, an effort must always be made in this regard.

Areas Of Concern In Present Study

- Average number of antibiotic prescribed to patient was much higher in our study as compare to other studies. This may be related to adverse reactions, drug interactions and noncompliance. It also increases the cost of therapy. (If treated in private hospitals)
- CST (culture sensitivity test) was not used in selection of appropriate antibiotic.
- The prescription made by junior residents of the concern ward were of poor quality in form of, handwriting was not easily understandable, poor recording of any ADR if occur, the different case sheet paper of successive days were attached only with a safety pin, which may fall away during routine work and may lead to loss of patient data and record.

SUMMARY AND CONCLUSION

Average number of drugs and antimicrobials prescribed per patient was higher than other studies. The most commonly prescribed antimicrobial agents were from Cephalosporin, Macrolide, Aminoglycoside followed by Penicillin group. Majority of the patients received multiple antimicrobial agent. Prescription of drugs was only by generic name. Parenteral route was preferred for antimicrobial agent. Rate of addition or change of antimicrobials was higher than other study. Almost Two third drugs were prescribed from WHO Essential Medicines List and NLEM.

The study concludes that the treatment regimen implemented in most of the cases is empirical, without doing any culture sensitivity test which may lead to wide spread practice of irrational prescribing.

Limitations Of The Present Study

- Present study was cross sectional study with limited duration.

Hence, longitudinal studies of longer duration are needed to confirm and establish our findings.

- Relatively less number of patients were studied.
- The data are collected from the indoor ticket of the patients, quality of which was very poor so there were more chances of poor quality data acquisition.
- Patients were not followed up after their discharge from the ward.
- There were very few similar studies available to compare.
- The drugs were supplied free of cost by the government, so the costs of different brands could not be calculated.
- The study was limited to indoor paediatric patients and only in one unit of the department with limited number of patients, so could not evaluate generalized pattern in the institution.
- Choice of treatment also varies from physician to physician and the study provides no data for the same.

The study can be expanded in future including different units of department, to evaluate generalized pattern of antibiotic utilization as well as antibiotic utilization in vulnerable groups. The study can also be expanded as a comparative antibiotic utilization study amongst government versus private sector to analyse, evaluate and promote rationale drug prescribing in both sectors.

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Conflict Of Interest: None declared

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