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Study of the Prescribing Pattern of Antibiotics on Paediatric Population in a Tertiary Care Teaching Hospital

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ABSTRACT

Background: Rational antibiotic prescription is very important to prevent antibiotics resistance. Widespread use of antibiotics has facilitated the development of resistance. **Objective:** This study was intended to assess in the pediatric department the use of antibiotics in tertiary care hospital in India. **Methodology:** A prospective observational study was conducted in the Pediatric inpatient ward of a tertiary care hospital over a period of 6 months. Analysis of 355 case sheets of pediatric inpatients was done using medical records. Data was analyzed for average number of drugs prescribed, antibiotics prescribed by generic name or brand name, percentage of antibiotics among the prescribed drugs etc. **Results:** A total number of 355 cases, our results showed tendency of polypharmacy with maximum number of prescriptions were having 5.2 drugs. Single antibiotic were prescribed in most of prescriptions (63.6%), followed by two antibiotics. In the total patient the average number of antibiotics per prescription was 1.45%.In this study percentage of multiple antibiotics prescribed is 29% and this indicates delay of diagnosis or selection of inappropriate antibiotic without prior culture sensitivity testing. Ceftriaxone was most commonly prescribed antibiotics 86.1% of antibiotics were prescribed by Parental route and 14.4% by oral route. In oral dosage forms the most commonly used dosage form was syrup. Children are easy with the dosage form like syrup and drops compared to tablets and capsules. **Conclusion*:*** Antibiotic resistance is an emerging problem worldwide which can be controlled by rational prescription, restricting the number of antimicrobial prescription and appropriate selection of the drug.

INTRODUCTION

Pediatrics is the branch of medicines dealing with the development, diseases and disorders of children. Infancy and childhood is a period of rapid growth and development. Compared to adult medicines, drug use in pediatrics is not broadly researched and the range of licensed drugs in appropriate dosage form is limited. Effectual medical treatment of a pediatric patient is based upon accurate diagnosis and optimum course of therapy, which usually involves a medication regimen. Infants and children are among the most at risk population groups to contact illnesses. There are also reports of irrational use of antibiotics which may lead to infections that are worse than the originally diagnosed ones.[1] Antibiotics are the primary treatment of bacterial infections. Since the original discovery of penicillin by Sir Alexander Fleming in 1928, antibiotic use has saved millions of lives.[2]

The study of prescribing patterns is a part of the medical audit and seeks to monitor, evaluate and if necessary, suggest modifications in prescribing practices to make medical care rational and cost effective. The data will also be helpful in planning longitudinal studies on prescribing and drug use pattern. The objectives of study were to: (1) Obtain information on age, sex, length of stay and illness of patient admitted in the pediatric ward during the study period. (2) Obtains information on the prescribing patterns of drugs. (3) calculate the mean (±standard deviation) number of drugs prescribed per admission, and the percentage of drugs prescribed from the essential drugs lists. (4) Enumerate the specimens sent for culture and sensitivity testing, the organisms isolated and their antibiotic sensitivity patterns. (5) Calculate the mean cost of drugs per hospital admission and the percentage of the cost contributed by parental preparations and antibiotics.[3]Several studies focusing on antibiotic prescribing attitudes in hospitalized children indicate that approximately 35% of infants and children admitted to hospital receive antibiotics and widespread misuse has been reported. Higher incidence of infections in infants and children as compared to adults leads to higher use of antimicrobials and contribute to an overall increase in healthcare costs as well as potentially severe adverse drug reactions. Almost 50% of all antibiotic prescriptions are inappropriate, based on clinical and economic criteria. Irrational prescriptions by the medical practitioners and incentives provided by the drug companies for promotion of the sale of their products, also add to this health hazards by antimicrobials.[4]

The problems that result from the inappropriate use of antibiotics have been recognized by scientific, healthcare and policy-making institutions. This led to the development of strategies such as antimicrobial stewardship program (ASPs), which aim at improving antibiotic prescription with the end of achieving better clinical outcomes, reducing the incidence of adverse events associated within appropriate use, and increasing the cost-effectiveness of care.[5] Inappropriate use of antimicrobials is linked increasing antibiotic resistance due to important ecological effects. It represents a major public health problem worldwide generating increasing morbidity, mortality and hospitalization rates in recent years.[6]

The indiscriminate use of antibiotics often results in increased incidence of adverse drug reactions, suboptimal therapy, treatment failure, polypharmacy and most importantly, the emergence of antibiotic resistant bacteria have become a rampant problem in pediatric ICU.[7]

MATERIALS AND METHODS

This was a prospective observational study conducted for a period of Six months (September 2018-February 2019) at inpatient Pediatric department of a tertiary care teaching Hospital (CSI Holdsworth Memorial Hospital) Mysore. This study was approved by the Institutional Human Ethics Committee. The study was designed in accordance with objectives and criteria (Inclusion and Exclusion criteria). A special data collection form was designed to collect patient's data. Prescribers at the study sites included medical doctors and PG's. During the study, prescribing support for providers included on- and off-site pharmacy, pediatric infectious disease specialist and antimicrobial prescribing guidelines.

DATA COLLECTION

A trained research coordinator reviewed the medical records at time of enrolment and weekly thereafter until discharge or end of the study. Data collected included demographic characteristics (age, sex, IP number, date of admission), clinical diagnosis (acute GE, kidney disease, URTI, LRTI, liver diseases, seizure, febrile illness, dengue fever, enteric fever, Rickettsial fever, poisonous ingestion, meningitis, Steven Johnson syndrome, type 1 DM, UTI, viral fever and other diseases), antimicrobial prescriptions (indication, drug, duration), and associated diagnostic testing (bacterial and viral culture, reaction test for respiratory pathogens). Diagnostic testing was

performed at commercial medical centre laboratory, which follow the Clinical Laboratory Standards Institute for the identification of organisms and their susceptibilities, when appropriate. Only infections diagnosed and antibiotic courses initiated at the pediatric department were included in the analysis.

DATA ANALYSIS

Antibiotics were classified as Aminoglycoside, Beta-lactam antibiotics, Carbapenam, Cephalosporin, Fluoroquinolone, Macrolide, Glycopeptides, Nitroimidazole, Oxazolidinone, Tetracycline and other classes. Patient's primary diagnoses were grouped into 17 diagnostic categories. Consistent with the antibiotic drug evaluation method, antibiotic prescribing patterns were examined by patient age groups and sex, date of visit, antibiotic dosage form, ROA of dosage form, frequency of antibiotics, number of days antibiotic prescribed.

RESULTS:

A total of 1511 patients were admitted in the Pediatric ward of CSI Holdsworth Memorial mission Hospital, Mysore over a period of six months; from September 2018-February 2019. Among 1511 patients admitted, 355 patients were followed and out of 355 patients, Ceftriaxone was highly prescribed and Amoxicillin/Clavulanic acid caused more resistance.

PATIENT DEMOGRAPHICS:

Gender distribution of patient

In this study, a total number of 355 patients were enrolled out of which 205 (57.7%) is male and 150 (42.3%) is female patient.

AGE DISTRIBUTION:

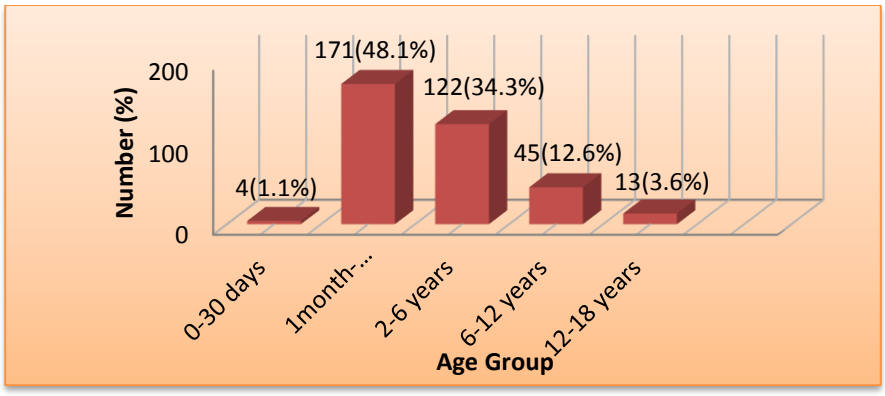

Figure No. 1: Age distribution of the study population

ALLERGIC STATUS:

Among 355 patients, 99% cases are no known allergies. Only1% was showing allergies to different medications like Vancomycin, Ceftriaxone and Amikacin.

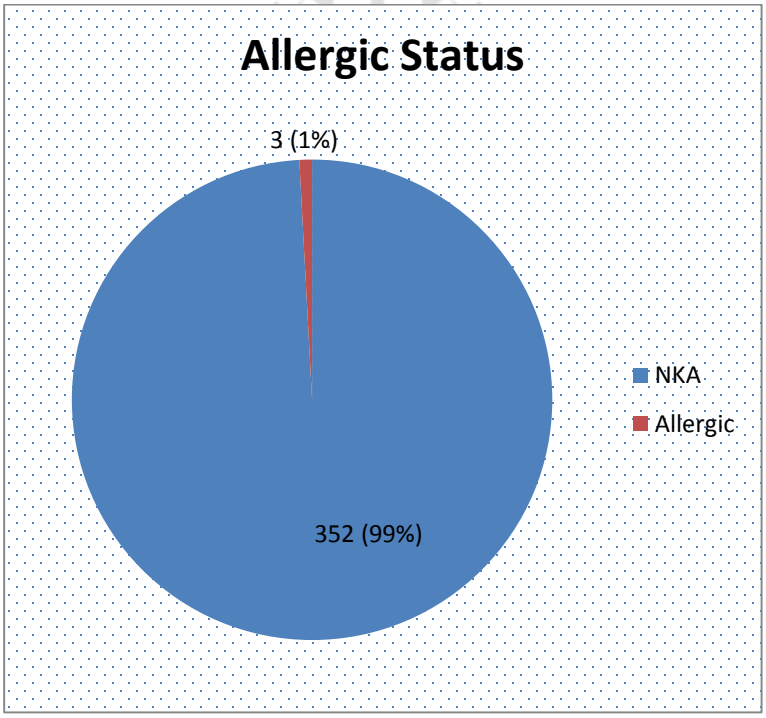

Figure No. 2: Allergic status

ROUTE OF ADMINISTRATION OF VARIOUS ANTIBIOTICS:

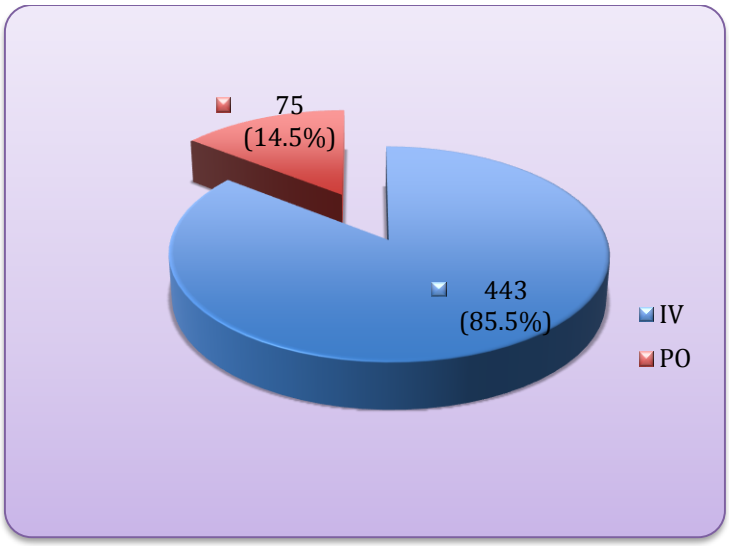

Figure No. 3: Route of administration

CLASS OF ANTIBIOTICS:

Table No. 1: Class of antibiotic

Class of Antibiotics	Number (%)
Aminoglycoside	93 (18%)
Anti-tuberculosis	8 (1.6%)
Betalactam antibiotics	82 (16%)
Carbapenam	10 (2%)
Cephalosporin	228 (44%)
Fluoroquinolones	16 (3%)
Macrolide	26 (5%)
Glycopeptides	19 (3.6%)
Nitroimidazole	8 (1.5%)
Oxazolidinone	1 (0.1%)
Tetracycline	27 (5.2%)

DOSE OF ANTIBIOTICS:

Table No. 2: Dose of antibiotics

Dose of Antibiotic	Number (%)
0-100 mg	35 (6.7%)
100-200 mg	88 (17%)
200-300 mg	110 (21.2%)
300-400 mg	12 (2.3%)
400-500 mg	31 (6%)
500-600 mg	88 (17%)
600-700 mg	34 (6.5%)
700-800 mg	22 (4.2%)
800-900mg	0 (0%)
900-1 g	1 (0.19%)
1-1.5 g	68 (13.41%)
1.5-2 g	29 (5.5%)

FREQUENCY OF VARIOUS ANTIBIOTICS:

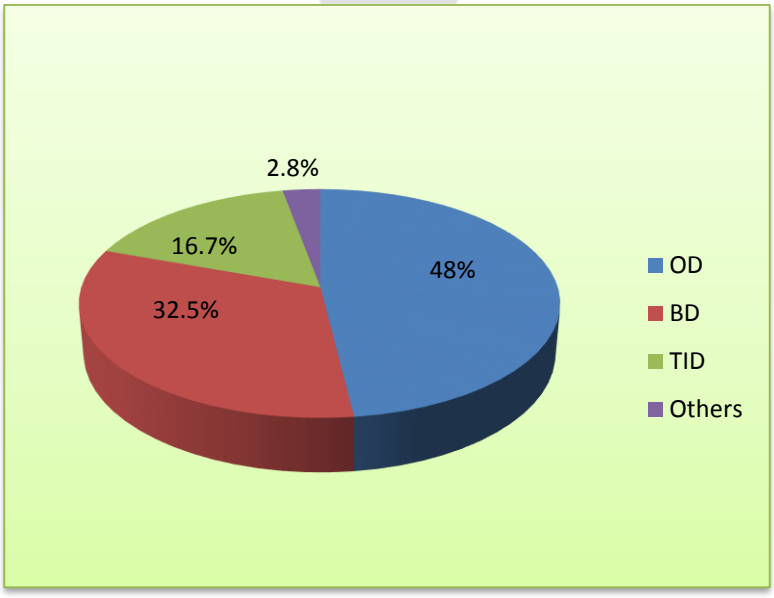

Figure No. 4: Frequency of antibiotics

NUMBER OF DAYS ANTIBIOTICS PRESCRIBED:

Table No. 3: Number of days of antibiotic

Number of Days	Number of Antibiotics (%)
1	30 (5.8%)
2	153 (29.7%)
3	178 (34.5%)
4	73 (14%)
5	43 (8.3%)
6	14 (2.8%)
7	16 (3.0%)
8	7 (1.3%)
9	3 (0.5%)
10	1 (0.1%)

FREQUENCY (%) OF INDIVIDUAL ANTIBIOTIC FOR SPECIFIC DIAGNOSIS:

Table No. 4: Antibiotics used for specific diagnosis

Diagnosis	Amikacin	Amoxicylin / Clavulunic acid	Azithromycin	Cefixime	Ceftriaxone	Ciprofloxacin	Doxycycline
Acute GE	23 (26.4)	2 (2.4%)	0	1 (20%)	28 (12%)	2 (25%)	1 (3.8%)
URTI	2 (2.2%)	7 (8.6%)	0	0	5 (2.1%)	0	0
LRTI	12 (13.7%)	54 (66.6%)	0	2 (40%)	60 (26.3%)	0	0
Liver disease	2 (2.2%)	0	13 (65%)	1 (20%)	1 (0.4%)	0	0
Seizure	7 (8%)	1 (1.2%)	2 (10%)	0	32 (14%)	1 (12.5%)	3 (11.5%)
Febrile illness	11 (12.6%)	4 (4.9%)	0	1 (20%)	34 (15%)	1 (12.5%)	8 (30.7%)
Enteric fever	2 (2.2%)	1 (1.2%)	0	0	18 (8%)	0	1 (3.8%)
UTI	19 (21.8%)	0	0	0	21 (9.4%)	0	1 (3.8%)
Viral fever	2 (2.2%)	3 (3.7%)	2 (10%)	0	3 (1.3%)	0	1 (3.8%)

DIAGNOSIS	GENTAMICIN	METRONIDAZOLE	MEROPENAM	OFLOXACIN	VANCOMYCIN	OTHER
Acute GE	0	0	0	4 (50%)	0	0
URTI	0	2 (25%)	0	0	0	3 (15%)
LRTI	0	0	3 (33.3%)	0	9 (56.2%)	14 (70%)
Liver disease	0	0	1 (11.1%)	0	0	1 (5%)
Seizure	0	0	3 (33.3%)	0	4 (25%)	0
Viral fever	0	0	0	0	0	1 (5%)

TOTAL NUMBER OF ANTIBIOTICS PRESCRIBED:

Table No. 5: Total number of antibiotics prescribed

Drugs	Number (%)
Amikacin	89 (17.1%)
Amoxicillin / clavulanic acid	83 (16%)
Azithromycin	24 (4.6%)
Cefixime	4 (0.7%)
Ceftriaxone	218(42%)
Ciprofloxacin	7(1.3%)
Clarithromycin	2(0.4%)
Doxycycline	27(5.8%)
Gentamicin	2(0.3%)
Metronidazole	8(1.5%)
Meropenem	10(2%)
Ofloxacin	11(2.1%)
Vancomycin	17(3.2%)
Other	16(3%)

TOTAL NUMBER OF ANTIBIOTIC PRESCRIBED PER PATIENT:

Table No. 6: Total number of antibiotics prescribed per patient

Drugs	Number of Patients (%)
1	226 (63.6%)
2	103 (29.3%)
3	17 (4.7%)
4	6 (1.6%)
5	3 (0.8%)

POTENTIAL DRUG-DRUG INTERACTION:

The total potential drug-drug interactions found in our study is 42% (n=17) out of this Moderate pDDIs were most prevalent followed by Minor 40% (n=16) and Severe 18% (n=7).

SERIOUS DRUG-DRUG INTERACTION:

Table No. 7: Serious drug-drug interaction

Sr. No.	Drug Interactions	Severity	Total Number (%)
1	Fluconazole + Ondansetron	Serious	1 (11.1%)
2	Ofloxacin + Ondansetron	Serious	1 (11.1%)
3	Azithromycin + Ondansetron	Serious	1 (11.1%)
4	Ciprofloxacin + Ondansetron	Serious	3 (33.4%)
5	Rifampicin + Isoniazid	Serious	1 (11.1%)
6	Clarithromycin + Dexamethasone	Serious	1 (11.1%)
7	Octreotide + Ondansetron	Serious	1 (11.1%)
	Total		9

MODERATE DRUG-DRUG INTERACTIONS:

Table No. 8: Moderate drug-drug interaction

Sr. No.	Drug Interactions	Severity	Total Number (%)
1	Doxycycline + Ceftriaxone	Moderate	4 (20%)
2	Lorazepam + Clobazam	Moderate	1 (4.7%)
3	Prednisolone + Theophylline	Moderate	1 (4.7%)
4	Budesonide + Theophylline	Moderate	1(4.7%)
5	Phenytoin + Dexamethasone	Moderate	1 (4.7%)
6	Amikacin + Gentamicin	Moderate	1 (4.7%)
7	Amikacin + Acyclovir	Moderate	1 (4.7%)
8	Phenytoin + Ondansetron	Moderate	1 (4.7%)
9	Phenobarbital + Lorazepam	Moderate	2 (9.5%)
10	Phenobarbital + Doxycycline	Moderate	1 (4.7%)
11	Rifampicin + Fluconazole	Moderate	1 (4.7%)
12	Rifampicin + Azithromycin	Moderate	1 (4.7%)
13	Azithromycin + Fluconazole	Moderate	1 (4.7%)
14	Epinephrine + Azithromycin	Moderate	1 (4.7%)
15	Linezolid + Epinephrine	Moderate	1 (4.7%)
16	Clarithromycin + Dexamethasone	Moderate	1 (4.7%)
17	Prednisolone + Dexamethasone	Moderate	1 (4.7%)
	Total		21(42.5%)

ADVERSE DRUG REACTION:

Table No. 9: Adverse drug reaction

Drugs	ADRS
Amikacin	Difficulty breathing
Amikacin	Increased thirst
Amoxicillin + clavulanic acid	Yellowing eye
Amoxicillin + clavulanic acid	Abdominal pain
Amoxicillin + clavulanic acid	Nausea
Ceftriaxone	Rashes on skin
Ceftriaxone	Diarrhea
Ceftriaxone	Red rashes on body
Ceftriaxone	Vomiting
Ceftriaxone	Skin rashes
Vancomycin	Red neck

CULTURE SENSITIVITY TEST:

Among 355 patients only 128 patients has undergone culture sensitivity test. It indicates delay of diagnosis or selection of inappropriate antibiotics without prior culture sensitivity testing.

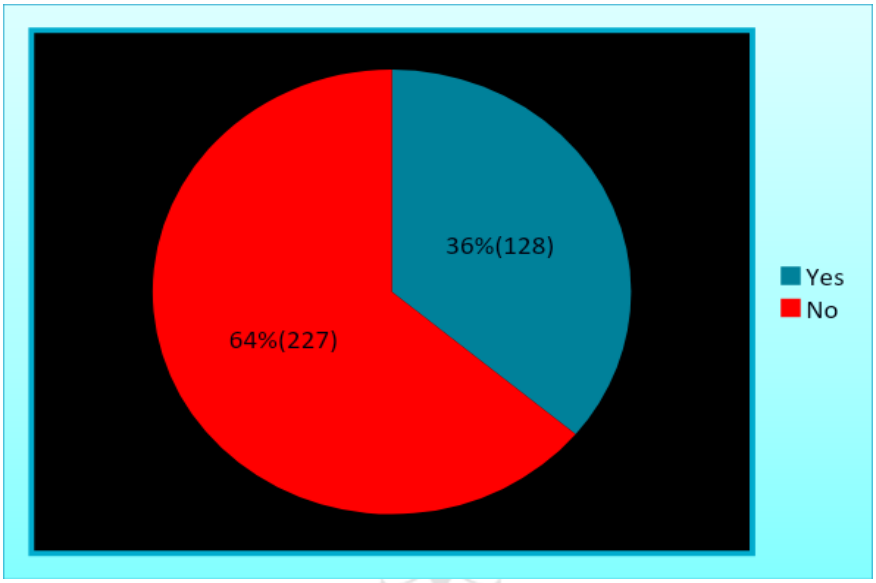

Figure No. 5: Frequency of antibiotics

RESISTANCE:

Table No. 10: Resistance of antibiotics

Drugs	Number (%)
Amikacin	6 (7.3%)
Amoxicillin + clavulanic acid	33 (40.2%)
Azithromycin	7 (8.5%)
Ceftriaxone	32 (39.2%)
Ciprofloxacin	2 (2.4%)
Doxycycline	2 (2.4%)

DISCUSSION

The present study was carried out by analyzing 355 inpatient case sheets of Paediatric patients randomly selected from medical record over 6 months period.

There was preponderance of male patients in our study which could be the reflection of general pattern of sex distribution in the population of the vicinity of study site. This could be due to the common tendency of overcautious apprehension of parents towards the health of male child. More number of peadiatric patients admitted in the wards belonged to 1 month- 2 years of age (48.1%) suggesting that children of this age group are more susceptible for infections.

Average number of drugs per person is an important index of prescription audit. Mean number of drugs per prescription should be kept as low as possible. The WHO recommends that the average number of drugs per prescription should be less than two. Average number of drugs prescribed per patient was 5.2 drugs. It could be due to in-patient nature of the study. Higher figures (polypharmacy) always lead to increased risk of drug interaction, adverse effects, development of bacterial resistance, increased hospital cost.

Single antibiotic were prescribed in most of prescriptions (63.6%), followed by two antibiotics. Average number of antibiotics per prescription was 1.45%. In this study percentage of multiple antibiotics prescribed is 29% and this indicates delay of diagnosis or selection of inappropriate antibiotic without prior culture sensitivity testing. This could also be due to more severe form of diseases which failed to respond to single antibiotic treatment. All the antibiotic prescriptions were based on clinical diagnosis, not on culture sensitivity test report. It is important to obtain proper specimen, examination and culture for selection of proper antibiotics. This can prevent development of antibiotic resistance, reduces the side effects of drugs and also decreases the cost of treatment.

In present study, 85.5% of antibiotics were administered by parenteral route and 14.4% by 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 syrup. Children are comfortable with the dosage form like syrup and drops compared to tablets and capsules. It increases compliance and helps in completing the treatment regimen.[8-15]

CONCLUSION

This study concluded that potential drug interactions are one of the major concerns that every patient under therapy with multiple drugs prescription suffer from which is a major challenge for

ensuring drug safety along with effective treatment by systematic drug monitoring for potential interactions. This study initiated and helped to establish interdisciplinary rapport and care between clinical pharmacist and physicians in various departments of hospital by helping providing required interventions and when required on case-to-case basis for all the identified cases of drug interactions. Indian hospital setup lacks qualified clinical pharmacists for provision of interventions which was tried to bridge by our study through interventions.

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