Original Article

Antibiotics prescribing pattern in the in-patient departments of a tertiary care hospital

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ABSTRACT

Context: Antibiotic prescribing by physicians has gained due importance across the globe, mainly because of an increase in antibiotic usage, prevalence of infections, and drug resistances.
Aims: The present study aimed to evaluate the prescribing pattern of antibiotics, their adherence to essential medicines list, disease conditions for which they were prescribed, and their adverse effects.
Settings and Design: A cross-sectional prospective study was carried out in six inpatients departments (Surgery, Orthopedics, ENT, Ophthalmology, Medicine, and Pediatrics) of a 550-bed tertiary care hospital in Trivandrum, India for two months (July-August 2012). Institutional Research and Ethics Committee clearance were obtained prior to the study.
Materials and Methods: The data were collected in a predesigned performa from the medical case sheets, drug charts, and laboratory investigations of 100 in-patients. The enrolled patients were observed from admission till discharge. Descriptive statistics were applied to the collected data and analyzed using Microsoft Excel software.
Results: The mean duration of hospitalization among the study population was 5.48 (±4.28) days. Of the 410 medicines prescribed, antibiotics contributed 151 (36.8%). They were mostly indicated for respiratory infections, and the most common antibiotic was Beta-lactams (91 (60.2%). Interestingly, 89 antibiotics (60%) were administered as injections. About 70 (46%) of the antibiotics were prescribed without any combinations. The adherences to World Health Organization's essential medicines list were 122 (81%). A total of seven adverse drug reactions were reported in the current study. Of which, none were serious, and five (70%) were cutaneous reactions.
Conclusions: Of the 100 patients analyzed from six in-patient departments, it was observed that the hospital physicians prescribed antibiotics more rationally with no banned drugs and less newer drugs. Rational prescribing of antibiotics would help avoid polypharmacy and prevent drug resistances.

INTRODUCTION

The remarkable discovery of penicillin by Sir Alexander Fleming in 1928 was the beginning of the antibiotic revolution, which changed the course of modern medicine.[1] Antibiotics have effectively prolonged the life expectancy. Antibiotics are currently the most commonly prescribed drugs in hospitals, worldwide.[2] But, excessive and inappropriate use of antibiotics renders increased drug resistance.[3] The rational use of antibiotics is a major health need.

In a developing country like India, the cost of health care is a key cause for concern. The practitioners should be made aware of the importance of combination therapy in the treatment of certain infections, so that the chance of resistance development can be ameliorated to the most possible extent. Many studies have implicated that the antibiotics are among the major group of drugs, which cause adverse drug reactions (ADRs).[4]

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Prevention of ADRs is possible by proper monitoring, which fortified the national directive to institutionalize a pharmacovigilance center in every medical college in the country.[5,6] Quality of treatment can be improved by setting certain standards at all levels of health care delivery systems. It is important to assess the quality of patient care through proper surveillance.

The study of prescribing pattern infers to monitor, evaluate, and suggest modifications in the practitioner's prescription habits, so as to make patient care reasonable and effective.[7] The knowledge about antibiotic utilization patterns is necessary for a constructive approach to problems that arise from multiple antibiotic usages. It is extremely important that institutions and hospitals should have an antibiotic policy and ensure that the best choices are made by individual prescribers.[8] A highly representative data aid the prescribers in rational antibiotic use and can improve the quality of patient care. This further envisages the need for the current study.

MATERIALS AND METHODS

Study design, setting, and study population

The present research was a cross-sectional prospective study carried out in six in-patient departments (Surgery, Orthopedics, ENT, Ophthalmology, Medicine, and Pediatrics) of a 550-bed tertiary care hospital in Trivandrum, India between July 2012 and August 2012.

Patients (n = 100), who were hospitalized due to infections or had acquired infections after hospitalization and were on antibiotic treatment or prophylaxis, were enrolled by consecutive sampling. The patients who visited the out-patient departments, who were unconscious/mentally retarded, who were suffering with psychiatric diseases, and who were admitted into intensive care unit, were excluded from the study. The enrolled patients were observed from admission till discharge.

Data Collection

Medical case sheets, drug charts, and laboratory investigations were recorded in a self-designed standardized performa and analyzed. The collected data included the following elements: Demographics, current diagnosis, medical history, medications prescribed {dose, route of admission, frequency, therapy duration, indication, pharmacological classification, marketing categories [generic or branded, single or fixed dose combination, and new or old drugs per Central Drug Standard Control Organization (CDSCO) – India classification]}, and ADRs occurred to the sample population.

Rationality of antibiotic prescription

The drug utilization was assessed by the World Health Organization (WHO) core drug use indicators such as prescribing indicators and health facility indicators.[9-11] The total number of drugs prescribed, average number of drugs per prescription, percentage of antibiotics prescribed, number of antibiotics used as monotherapy and in combinations, and any banned drugs/formulations were noted. The adherence of antibiotic prescription was checked with the WHO essential medicines lists (EML).[12] The prescribing physicians were not told of the prescription audits in order to prevent Hawthorne effect.[13]

Recording of ADRs

ADRs occurred with antibiotics were recorded in the *CDSCO Suspected ADR Reporting Form*.[14] For each ADR, the following information were recorded: Type of adverse event, seriousness, onset and resolution, severity, casualty, action taken, and event outcome, and was analyzed using the following methods: Causality assessment by WHO and Naranjo scales, severity by Hartwig scale, and preventability using the definitions proposed by Schumock and Thornton.[15-18]

Ethical considerations

The study was complied fully with the WHO guidelines and was done after obtaining approval from Institutional Research and Ethics Committee.

Statistical analysis

Descriptive statistics were applied to the collected data using Microsoft Excel software. Results are expressed in percentages and mean-standard deviation (SD).

RESULTS

The study population of 100 patients included 60 males and 40 females. Mean age of the pediatric patients were 4.04 (±3.91) years, and patients of other departments were 44.4 (±17.56) years. The age distribution is shown in Figure 1. Their co-morbid disease conditions are listed in Table 1.

The mean duration of hospitalization was 5.48 (±4.28) days. A total of 410 drugs were prescribed, and thus the average number of drugs per patient was 4.1. In this, the antibiotics per prescription were 1.5. About 16 (10.5%) antibiotics were prescribed by generic name. The fixed dose combinations of antibiotics constituted 25 (16.7%). Beta-lactams antibiotics were

the most common pharmacological class of drugs prescribed 90 (60.2%). Of which, cephalosporins comprised 47 (51.7%). Cefazolin was the most commonly used drug for surgical prophylaxis 18 (12%). Department-wise distribution of patients on antibiotic therapy is shown in Figure 2. The commonest diagnosis/indication that led to antibiotics prescription was respiratory tract infections [Table 2].

The dosage forms used in the study are depicted in Figure 3. Most commonly used dosage form for antibiotics were injections 89 (60%). About 70 (46%) antibiotics were used as monotherapy. The prescribing frequency of antibiotics is depicted in Figure 4 and various Beta-lactams in Figure 5. The antibiotics prescribed from WHO EML were 122 (81%). Table 3 depicts the WHO core drug use indicators. About seven (7%) ADRs were noted and were predominantly cutaneous reactions five (5%) [Table 4].

The culture and sensitivity testing were performed, and the resistant strains of *Pseudomonas aeroginosa*, *Klebsiella Pneumonia*, and *Escherichia coli* were isolated. Results showed that *E. coli* was sensitive to piperacillin, tazobactam, amikacin; and it was resistant to cefuroxime, ceftriaxone, ceftazidine, ampicillin, ciprofloxacin, and cotrimoxazole. *P. aeroginosa* was sensitive to piperacillin, tazobactam, ceftazidine, and cefoperazone. *K. pneumonia* was sensitive to piperacillin, tazobactam, and imipenam. Resistance

Table 1: Co-morbidities associated with patients

Co-morbidities	Patients, *n* (%)
Diabetes mellitus	15 (15)
Hypertension	9 (9)
Bronchial asthma	5 (5)
COPD	3 (3)
Liver disease	2 (2)
Osteoarthritis	3 (3)
Neurological conditions	2 (2)

COPD= Chronic obstructive pulmonary disease

Table 2: Systemic infections and percentage of patients on antibiotics

Indications	Patients, *n* (%)
Respiratory infection	30 (30)
Surgery related	16 (16)
Bone	15 (15)
Diabetes mellitus	11 (11)
GIT	6 (6)
Eye	6 (6)
Urinary tract	6 (6)
Fever	6 (6)
Cutaneous	5 (5)
Carcinoma/Papilloma	3 (3)

GIT= Gastrointestinal tract

Table 3: Prescribing indicators

Prescribing indicators	Results
Average number of drugs per prescription*	4.1±2.9[a]
Average number of Antibiotics per prescription*	1.5±0.89[a]
Percentage of antibiotics prescribed by generic name*	10.5%
Percentage of antibiotics prescribed by brand name	89.5%
Percentage of antibiotics with fixed dose combinations	16.78%
Percentage of antibiotics from essential medicines list*	81%
Percentage of antibiotics with injections *	60%
Monotherapy of antibiotics	70 (46%)

*WHO core drug indicators, [a](Mean±SD), All other values are represented in percentage

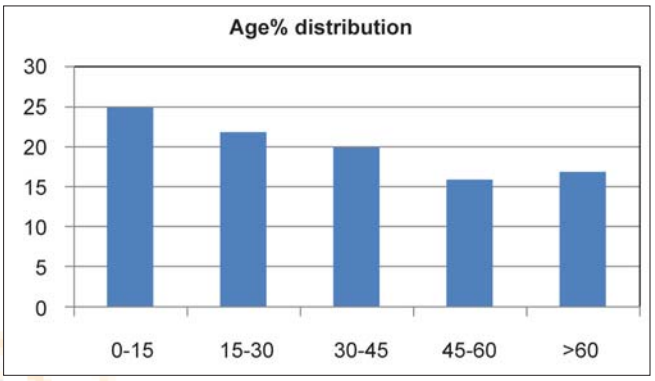

Figure 1: Age distribution of patients

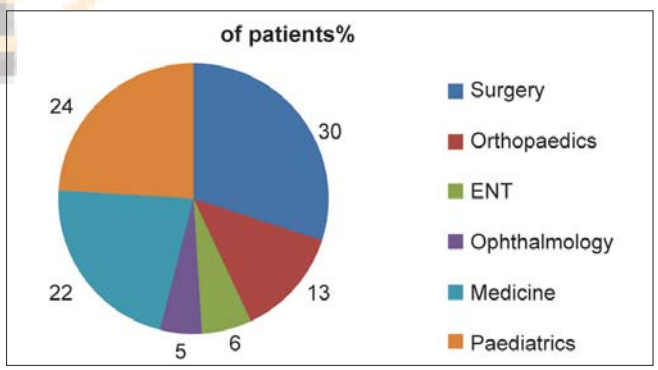

Figure 2: Department-wise distribution of patients

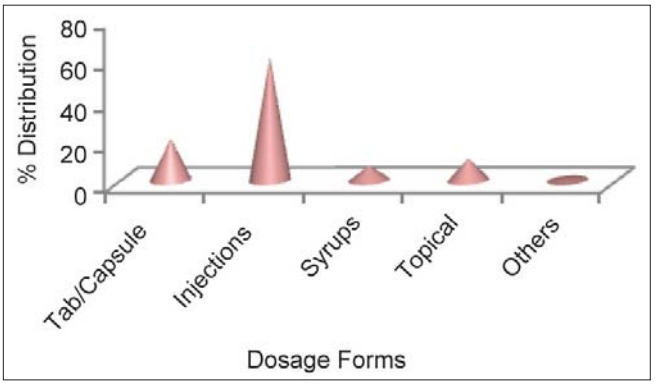

Figure 3: Dosage forms of antibiotics

Table 4: ADRs and their assessments

Drug	Dosage form	Reaction	System	WHO causality	Naranjo causality	Severity	Preventability
Ciprofloxacin	Injection	Allergy, itching	Cutaneous	Probable	Possible	Moderate	Not preventable
Amoxicillin and clavulanic acid	Tablet	Erythema, itching	Cutaneous	Possible	Probable	Mild	Preventable
Ampicillin	Capsule	Rashes	Cutaneous	Possible	Possible	Mild	Preventable
Ciprofloxacin	Tablet	Vomiting, abdominal pain	Gastro-intestinal	Possible	Possible	Mild	Probably preventable
Cefazolin	Injection	Rashes	Cutaneous	Possible	Probable	Mild	Not preventable
Gentamicin	Injection	Vomiting	Gastro-intestinal	Probable	Possible	Moderate	Not preventable
Ampicillin and cloxacillin	Capsule	Erythema, papules, itching	Cutaneous	Possible	Possible	Mild	Not preventable

WHO=World health organization, ADRs=Adverse drug reactions

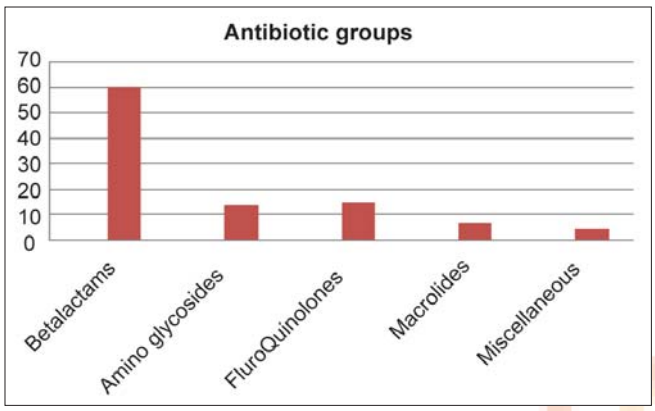

Figure 4: Prescribing frequency of antibiotics

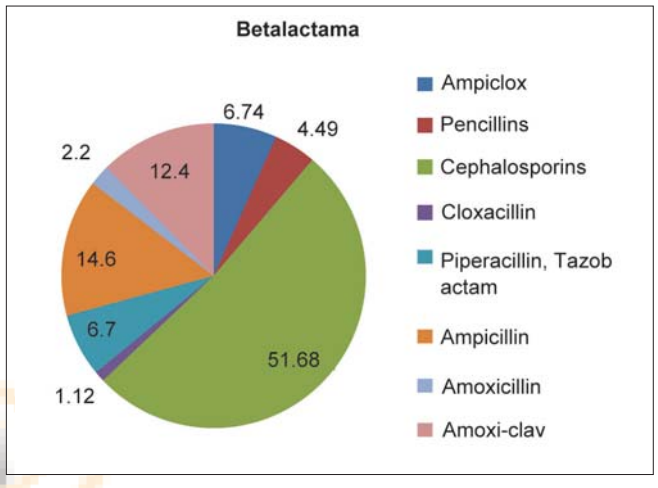

Figure 5: Various Beta-lactams used

was found to be more for ampicillin, cefazolin, and cefuroxime, whereas sensitivity was more for gentamicin, imipenam, piperacillin, tazobactam, and amikacin.

DISCUSSION

Most infections, including the infections of nosocomial origin, are serious in nature and require longer and complex treatment procedures. The treatment modalities for such infections always include antibiotics. As the drug resistance is on the raise, there is a huge need for taking steps to promote rational antibiotics use. Antibiotics are the most commonly used and misused drugs by patients and prescribers.[19] Early disease recognition and early start of corrective treatments for such infections were proved to have significant outcomes in terms of treatment effectiveness.[20] The periodic auditing of antibiotic prescriptions ensures the rational use of drugs by adhering the WHO guidelines.[21]

Pharmacoepidemiological studies focus on both beneficial and harmful effects of drugs. In the present study, the observation of demographic details (like age and sex etc) and information on infections, co-morbidities, and drug safety analysis (recording of ADRs, assessing its causality, severity, and preventability) had served this purpose. The mean hospitalization in the current study was five days. From a pharmacoeconomic point of view, the complexity in drug therapies, mainly due to increased resistance, has made patients to spend more for their treatments. The cost also increases with the increase in the number of drugs and days of hospitalization. Interestingly, the most number of antibiotics were prescribed for respiratory infections in the present study. The more use of Beta-lactam antibiotics is consistent with the established proof of their effective role in managing infections in the respiratory infections.[22]

Antibiotics are considered as the second most prescribed drugs in the world, only next to the drugs indicated for cardiovascular diseases.[23] Antibiotics constituted about 36% of the total drugs prescribed in this study, indicating the controlled and rational use of drugs by the hospital physicians. Predicting the risk in using these drugs for potential resistance is a mandate in any clinical settings. The culture

and sensitivity testing performed in the present study indicated the resistance of some pathogens to a number of antibiotics. The findings would help to prescribe appropriate and rational drugs to the patients, though the drug resistance was more for the most commonly prescribed antibiotics in the hospital. Literature has suggested the use of new mathematical models to predict easily.[24] The occurrence of only seven ADRs confirms that the prescribed antibiotics are safe and tolerable. Though potential polypharmacy was observed in most of the study population, no banned drugs per CDSCO were prescribed in the study. Moreover, there was a very less use of newer antibiotics. Interestingly, the prescription of Ampiclox (a fixed dose combination of Ampicillin and Cloxacillin) was observed in four occasions (6.74%), and the rationality of its use is doubtful. Self-administration of antibiotics is considered as a key reason for irrational use, followed by inappropriate prescription by physicians. The role of pharmacists in proper dispensing of antibiotics also plays a major role in this. A global survey reported the trend of using leftover drugs and recommended to dispense only the exact number of pills to the patients.[25] Better physician-pharmacist relationship can promote rational antibiotics usage to a larger extent.

The key limitation of the present study is sample size. As this is a pilot cross-sectional analysis of 100 patients, the results may be biased. The other constraint was the non-usage of computerized system of documentations by prescribers in the hospital. A periodic survey with increased number of subjects is needed for implementation of antibiotic policies.

CONCLUSIONS

Of the 100 patients analyzed from six in-patient departments, it was observed that the hospital physicians prescribed antibiotics more rationally with no banned drugs and less newer drugs. The adherence to WHO EML was found to be 81%. The culture and sensitivity testing suggested that the drug resistance was more for the most commonly prescribed antibiotics in the hospital. Early signals of irrational use of drugs can be detected by frequent prescription auditing. This should be followed by analytical studies to link the drug utilization data to figures on morbidity, outcome of treatment, quality of care, and ultimately assess the rationality of drug therapy.

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