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Original Article

Pharmacology Section

Prescription Pattern of Antibiotics in Admitted Patients of a Tertiary Care Government Teaching Hospital, Kerala, India

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ABSTRACT

Introduction: Antibiotics have a remarkable role in prolonging life, especially in underdeveloped and developing countries. Insufficient knowledge among doctors, peer pressure and patient demands, diagnostic uncertainties, lack of communication between the doctor, pharmacist and patients all implicate inappropriate antibiotic prescribing practices. Irrational antibiotic prescription can lead to antibiotic resistance, marking a global crisis.

Aim: To evaluate the prescription pattern of antibiotics in the admitted patients of a tertiary care teaching hospital and assess the prescriptions' rationality.

Materials and Methods: This was a retrospective record-based study done in the inpatients of Government Medical College, Manjeri, Kerala, India, for three months (1st October 2017 to 31st December 2017). Data was collected using a data collection checklist which included patient identity and demographic factors, name and route of the antibiotic prescribed, usage of multiple antibiotics, usage of prophylactic antibiotic, usage of generic names, adherence to National List of Essential Medicines (NLEM) and rational use. The data was analysed using Statistical Package for the Social Sciences (SPSS) version 16.0 and frequencies and percentages were determined for each variable.

Results: Total 1,186 medical records were analysed, and 49.7% were prescribed antibiotics; 38.2% contained more than one antibiotic, and 64.8% contained parenteral antibiotics. Cefotaxime was found to be the most commonly prescribed antibiotic. An 88.3% of prescriptions were adhering to NLEM, and 29% contained generic names of antibiotics. Overall, 69 out of 589 (11.7%) were irrational prescriptions, and the use of multiple antibiotics with the same spectrum of coverage was found to be the most common reason for irrationality.

Conclusion: In this study, the most prescribed drugs were from the NLEM. Cephalosporins were the most commonly used antibiotics for the inpatients in this hospital. Prescriptions with generic names of drugs were low. Irrational prescriptions contributed a minor percentage, and reserve antibiotics were too little.

Keywords: Antimicrobials, Inpatients, Rationality, Record-based

INTRODUCTION

In developing countries like India, where infectious disease load is high, antibiotics are one of the most commonly used drugs [1]. The era of antibiotics started with the discovery of Penicillin by Alexander Fleming in 1928. Interestingly, Alexander Fleming himself also sounded off the concept of antimicrobial resistance during his Nobel lecture in 1945 [2]. Mushrooming numerous new classes of antibiotics with excellent safety reports has resulted in lax prescribing standards and significant inappropriate antibiotic usage in many parts of the world.

Rost LM et al., reported that 30-50% of antibiotics are prescribed inappropriately without adherence to prescription guidelines [3]. Reports from the literature substantiate irrational and unnecessary usage of antibiotics in every sector of patient encounter viz., outpatient department, inpatient department, even in intensive care units [4,5]. This practice, if unchecked, will dramatically increase the chance of antibiotic resistance, especially in resource-limited countries [6,7].

Antibiotic resistance annually causes 23,000 deaths in America, 25,000 deaths in the European Union, and 700,000 deaths worldwide [8]. Studies have identified Extended Spectrum Beta-Lactamase (ESBLs) in 70-100% of Enterobacteriaceae in India and extensive uncontrolled use of carbapenem group of antibiotics to tackle ESBL producers which has resulted in carbapenem resistance in the form of New Delhi Metallo-Beta-Lactamase (MBL) in India [9]. By 2050, it is predicted that there will be 10 million deaths annually and US$100 trillion in global economic loss caused by drug-resistant bacterial infections if antibiotic resistance continues to rise at the same pace as in the last decades [8]. Irrational antibiotic prescribing leads to therapeutic failure and bacterial resistance, adverse effects, morbidity and mortality, economic burden, consultations, and fall in the quality of treatment. Thus, combating antibiotic resistance is the need of the hour. Hospital Infection Control Committees (HICC) and Antibiotic Stewardship Programs play a key role in preventing antibiotic resistance. Antibiotic Stewardship Programs are key interventional programs that continuously collect, analyse, and audit antibiotic consumption data, focusing mainly on the quality and rationality of antibiotic prescriptions. There are marked variations in the antimicrobial prescription pattern from region to region, which could be explained by variations in infecting microbes, drug susceptibility, physician preferences, and drug price. Analysis of regional variations in the pattern of antibiotic prescriptions has an important role in formulating policies and guidelines for combating antibiotic resistance, both worldwide and locally [10,11].

Monitoring antibiotics use from time-to-time, identifying the factors leading to their inappropriate use, and suggesting interventions are essential in slowing the pace of resistance development. The World Health Organisation (WHO) (1993) and the International Network for the Rational Use of Drugs (INRUD) have developed indicators for monitoring the rational use of drugs, these indicators are widely used to assess the quality of prescribing in health delivery systems [12]. The guide for the development of a program to rationalise the use of antimicrobials in hospitals, developed by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America, indicates the audit of antibiotics with interaction, intervention, and feedback to the physician who prescribe the drug as an essential strategy to promote fair and appropriate use [13].

A recent systematic review and meta-analysis study from Iran reports that, antibiotic prescribing rates surpass WHO recommendations, and educational interventions to physicians and showed a negligible effect in reducing antibiotic prescriptions [14]. Even then, assessment of the antibiotic prescription pattern in medical records has its role in identifying rational use of antibiotics, assessing the status of resistance, providing feedback to the HICC and clinicians, and proposing interventions required in formulating the new antibiotic policy for the institution.

Also, understanding the prescription pattern of antibiotics is the initial step towards antimicrobial stewardship programs in resource-limited countries [6]. Keeping this in mind, this study was undertaken to assess the prescribing pattern of antibiotics in the inpatient department of the institution. The aim was to study the prescription pattern of antibiotics administered to the inpatients, and to assess the rationality of prescribing antibiotics.

MATERIALS AND METHODS

This was a retrospective record-based study done in the inpatients of Government Medical College, Manjeri, a tertiary care teaching hospital in Kerala, India, for three months (1st October 2017 to 31st December 2017). The study was carried out after the approval of the Institutional Review Board (IRB) and Institutional Ethics Committee (IEC) (Ref. No: IEC/GMCM/17/17). The medical records were collected from the medical records library of the institution.

Inclusion criteria: All medical records available during the study period were taken for data collection.

Exclusion criteria: Medical records which were not legible due to poor handwriting were excluded.

Study Procedure

Overall, 1,186 records were audited, and the data regarding antibiotic prescriptions were collected. Data was collected using a data collection checklist which includes patient identity and demographic factors, name and route of the antibiotic prescribed, usage of multiple antibiotics, usage of Fixed Dose Combinations (FDCs), usage of prophylactic antibiotic, usage of generic names, adherence to NLEM and rational use. The data collected were kept strictly confidential and were used for this study only. The data regarding the drugs prescribed were analysed in accordance with the WHO [15] recommended prescribing indicators and were expressed as percentages and averages:

1. The average number of antibiotics prescribed.
2. Percentage of drugs prescribed by their generic name.
3. Level of adherence in prescribing of drugs from the NLEM-2011.
4. Percentage of the prescribed antimicrobial drugs.
5. Percentage of prescriptions with parenteral antibiotics.

STATISTICAL ANALYSIS

The data were entered in Microsoft Excel sheet, and the entire data were analysed using SPSS version 16.0. Frequencies and percentages were determined for each variable.

RESULTS

Out of 1,186 medical records, the ones which included antibiotic prescriptions were 589 (49.7%). Among them, 240 (40.7%) were males and 349 (59.3) were females. The mean age of the patients was 37.43 years. Young adults (21-40 years) were the most frequently prescribed age group, which accounted for 223 out of (37.9%), and elderly patients (above 60 years of age) were the least, which represented 114 (19.3%). The medical records audited included seven departments in which majority of the prescriptions were from Department of Obstetrics and Gynaecology 185 (31.4%) [Table/Fig-1].

Of the 589 records, 364 (61.8%) were with a single antibiotic. Total 225 records (38.2%) consisted of multiple antibiotics, among which 98 (43.6%) contained accepted FDCs. Total 70 records (31.1%) were with two antibiotics, and 57 (25.3%) were with three or more

Patient characteristics	Number (%)
Sex	
Males	240 (40.7)
Females	349 (59.3)
Age group (years)	
<20	132 (22.4)
21-40	223 (37.9)
41-60	120 (20.4)
>60	114 (19.3)
Department	
General Medicine	97 (16.5)
General Surgery	96 (16.3)
Obstetrics and Gynaecology	185 (31.4)
Paediatrics	45 (7.6)
Orthopaedics	53 (9)
Ophthalmology	67 (11.4)
ENT	46 (7.8)

[Table/Fig-1]: Gender-wise, age-wise, and department-wise distribution of medical records (n=589).
ENT: Ear, nose and throat

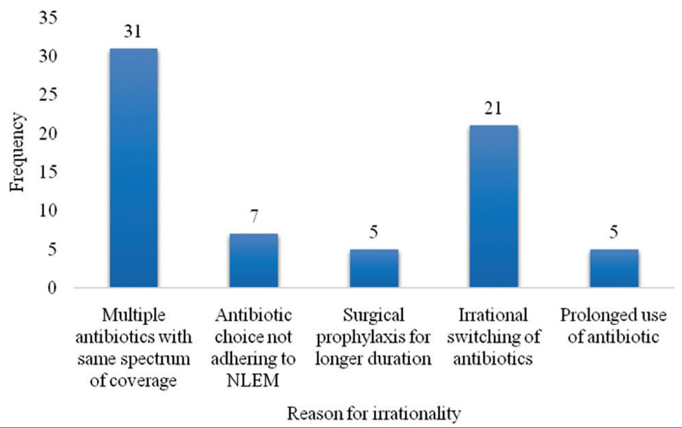
antibiotics. The total number of antibiotics prescribed was 954. Among this, 326 (34.2%) were oral, 618 (64.8%) were parenteral and 10 (1%) were topical. Prophylactic antibiotics were present in 270 medical records. Generic names were prescribed in 171 records which represented about 29%. Total 520, among the 589 records with antibiotics, were rational prescriptions adhering to NLEM [Table/Fig-2].

Antibiotics used	Frequency (%)
Single antibiotics	364 (61.8)
Multiple antibiotics	225 (38.2)
Multiple antibiotics (n=225)	
2 antibiotics	70 (31.1)
3 or more antibiotics	57 (25.3)
Accepted FDC	98 (43.6)
Total	225 (100)
Dosage forms of antibiotics	
Oral	326 (34.2)
Parenteral	618 (64.8)
Topical	10 (1%)
Prophylactic antibiotics	
Yes	270 (45.8)
No	319 (54.2)
Generic names	
Yes	171 (29)
No	418 (71)
NLEM adherence	
Yes	520 (88.3)
No	69 (11.7)

[Table/Fig-2]: Frequency and percentage of multiple antibiotics, prophylactic antibiotics, FDCs, dosage forms of antibiotics, usage of generic names, and NLEM adherence.

Sixty-nine were irrational prescriptions, and the most frequent reason for irrationality happened to be the use of multiple antibiotics with the same spectrum of coverage (44.9%). Switching antibiotics without any scientific reason was another fundamental cause of irrational prescriptions [Table/Fig-3].

The most prescribed antibiotic group was cephalosporins, followed by penicillins. Total 330 out of 954 antibiotics were cephalosporins, and 229 were penicillins [Table/Fig-4].



[Table/Fig-3]: Reasons for irrationality.

Antibiotics group	Number (%)
Aminoglycosides	66 (7)
Antifungal	4 (0.4)
AntiTB	0
Antiamoebic	70 (7.3)
Antivirals	9 (0.9)
Betalactamase inhibitors	98 (10.3)
Cephalosporins	330 (34.6)
Fluroquinolones	87 (9.1)
Macrolides	24 (2.5)
Miscellaneous antibiotics*	20 (2.1)
Penicillins	229 (24)
Sulphonamides	2 (0.2)
Tetracyclines	14 (1.5)
Urinary antiseptics	1 (0.1)

[Table/Fig-4]: Frequency and percentage of the commonly prescribed antibiotic groups (*Miscellaneous antibiotics included clindamycin, linezolid, vancomycin, rifaximin and fusidic acid).

Cefotaxime (15.3%) was the most frequently prescribed antibiotic followed by amoxycillin (13.8%), ceftriaxone (8.6%), ciprofloxacin (8.4%) and metronidazole (7.2%) [Table/Fig-5].

Specific antibiotics	Number (%)
Acyclovir	3 (0.3)
Amikacin	34 (3.5)
Amoxycillin	132 (13.8)
Ampicillin	63 (6.6)
Azithromycin	22 (2.4)
Cefoperazone	57 (5.9)
Cefazolin	3 (0.3)
Cefixime	7 (0.7)
Cefotaxime	145 (15.3)
Cefpodoxime	3 (0.3)
Ceftriaxone	82 (8.6)
Cefuroxime	33 (3.4)
Ciprofloxacin	79 (8.4)
Clarithromycin	2 (0.2)
Clavulanic acid	27(2.9)
Clindamycin	4 (0.4)
Clotrimazole	2 (0.2)
Cloxacillin	13 (1.4)
Crystalline penicillin	8 (0.8)
Doxycycline	14 (1.5)
Fluconazole	2 (0.2)
Fusidic acid	1 (0.1)
Gentamicin	32 (3.4)
Levofloxacin	3 (0.3)
Linezolid	10 (1)
Metronidazole	69 (7.2)
Moxifloxacin	2 (0.2)
Nitrofurantoin	1 (0.1)
Norfloxacin	2 (0.2)
Ofloxacin	1 (0.1)
Oseltamivir	6 (0.6)
Piperacillin	13 (1.4)
Rifaximin	4 (0.4)
Sulbactam	58 (6.1)
Sulfadiazine	2 (0.2)
Tazobactam	13 (1.4)
Tinidazole	1 (0.1)
Vancomycin	1 (0.1)
Total	954 (100)

[Table/Fig-5]: Frequency of specific antibiotics.

ATC codes and frequency of nine most commonly prescribed antibiotics are shown in [Table/Fig-6].

Each department's commonly prescribed groups of antibiotics and commonly prescribed drugs is shown in [Table/Fig-7].

Name of the drug	Drug group	Anatomical Therapeutic Chemical (ATC) code	Frequency n (%)
Cefotaxime	3rd generation cephalosporins	J01DD	145 (15.3)
Amoxycillin	Extended-spectrum penicillins	J01CA	132 (13.8)
Ceftriaxone	3rd generation cephalosporins	J01DD	82 (8.6)
Ciprofloxacin	Fluoroquinolones	J01MA	79 (8.4)
Metronidazole	Antiamoebic	P01AB	69 (7.2)
Ampicillin	Extended-spectrum penicillins	J01CA	63 (6.6)
Sulbactam	Betalactamase inhibitor	J01CG	58 (6.1)
Cefoperazone	3rd generation cephalosporins	J01DD	57 (5.9)
Gentamicin	Aminoglycosides	J01GB	32 (3.4)

[Table/Fig-6]: Commonly prescribed nine antibiotics with ATC Codes.

Department	Commonly prescribed group of antibiotics		Commonly prescribed drug	
	Name	Frequency n (%)	Name	Frequency n (%)
Department of General Medicine	Cephalosporins	61 (6.4%)	Cefotaxime	26 (2.7)
			Ceftriaxone	26 (2.7)
			Cefoperazone	7 (0.7)
			Cefixime	1 (0.1)
			Cefuroxime	1 (0.1)
	Penicillins	28 (3.0%)	Amoxycillin	9 (0.9)
			Piperacillin	8 (0.8)
			Cloxacillin	4 (0.4)
			Crystalline Penicillin	4 (0.4)
			Ampicillin	3 (0.3)
	Beta-lactamase inhibitors	23 (2.4%)	Clavulanic acid	8 (0.8)
			Tazobactam	8 (0.8)
			Sulbactam	7 (0.7)
	Macrolides	18 (1.9%)	Azithromycin	16 (1.7)
			Clarithromycin	2 (0.2)

	Tetracyclines	14 (1.5%)	Doxycycline	14 (1.5)
	Aminoglycosides	8 (0.8%)	Gentamicin	5 (0.5)
			Amikacin	3 (0.3)
	Fluoroquinolones	5 (0.5%)	Levofloxacin	3 (0.3)
			Ciprofloxacin	2 (0.2)
	Miscellaneous antibiotics	5 (0.5%)	Rifaximin	4 (0.4)
			Fusidic acid	1 (0.1)
	Antifungal drugs	2 (0.2%)	Clotrimazole	1 (0.1)
			Fluconazole	1 (0.1)
	Antiviral drugs	2 (0.2%)	Acyclovir	1 (0.1)
			Oseltamivir	1 (0.1)
	Antiamoebic drugs	1 (0.1%)	Metronidazole	1 (0.1)
	Urinary antiseptics	1 (0.1%)	Nitrofurantoin	1 (0.1)
Department of Obstetrics and Gynaecology	Penicillins	157 (16.6%)	Amoxycillin	105 (11)
			Ampicillin	48 (5)
			Cloxacillin	3 (0.3)
			Piperacillin	1 (0.1)
	Cephalosporins	58 (6.1%)	Cefotaxime	44 (4.6)
			Cefoperazone	5 (0.5)
			Cefazolin	3 (0.3)
			Ceftriaxone	3 (0.3)
			Cefuroxime	1 (0.1)
			Cefixime	1 (0.1)
	Anti-amoebic drugs	27 (2.9%)	Metronidazole	26 (2.7)
			Tinidazole	1 (0.1)
	Aminoglycosides	9 (0.9%)	Gentamicin	8 (0.8)
			Amikacin	1 (0.1)
	Fluoroquinolones	8 (0.8%)	Ciprofloxacin	6 (0.6)
			Norfloxacin	2 (0.2)
	Beta-lactamase inhibitors	7 (0.7%)	Sulbactam	5 (0.5)
			Clavulanic acid	1 (0.1)
			Tazobactam	1 (0.1)
	Miscellaneous antibiotics	4 (0.4%)	Clindamycin	4 (0.4)
	Antiviral drugs	4 (0.4%)	Oseltamivir	4 (0.4)
	Macrolides	3 (0.3%)	Azithromycin	3 (0.3)
	Antifungal drugs	2 (0.2%)	Clotrimazole	1 (0.1)
			Fluconazole	1 (0.1)
	Sulfonamides	1 (0.1%)	Sulfadiazine	1 (0.1)
Department of General Surgery	Cephalosporins	88 (9.2%)	Cefotaxime	56 (5.9)
			Cefoperazone	20 (2.1)
			Ceftriaxone	5 (0.5)
			Cefixime	5 (0.5)
			Cefpodoxime	2 (0.2)
	Antiamoebic drugs	34 (3.6%)	Metronidazole	34 (3.6)
	Beta-lactamase inhibitors	32 (3.4%)	Sulbactam	20 (2.1)
			Clavulanic acid	12 (1.3)
	Penicillins	15 (1.6%)	Amoxycillin	11 (1.2)
			Cloxacillin	2 (0.2)
			Crystalline penicillin	2 (0.2)
	Aminoglycosides	10 (1%)	Gentamicin	10 (1)
	Miscellaneous antibiotics	10 (1%)	Linezolid	10 (1)
	Fluoroquinolones	4 (0.4%)	Ciprofloxacin	3 (0.3)
			Ofloxacin	1 (0.1)
	Sulfonamides	1 (0.1%)	Sulfadiazine	1 (0.1)
Department of Ophthalmology	Fluoroquinolones	66 (7%)	Ciprofloxacin	64 (6.7)
			Moxifloxacin	2 (0.2)
	Macrolides	2 (0.2%)	Azithromycin	2 (0.2)
	Cephalosporins	1 (0.1%)	Cefotaxime	1 (0.1)
	Aminoglycosides	1 (0.1%)	Gentamicin	1 (0.1)
Department of ENT	Cephalosporins	42 (4.4%)	Ceftriaxone	29 (3)
			Cefoperazone	11 (1.2)
			Cefotaxime	2 (0.2)
	Beta-lactamase inhibitors	14 (1.5%)	Sulbactam	12 (1.3)
			Clavulanic acid	1 (0.1)
			Tazobactam	1 (0.1)
	Aminoglycosides	13 (1.4%)	Amikacin	12 (1.3)
			Gentamicin	1 (0.1)
	Penicillins	4 (0.4%)	Amoxycillin	2 (0.2)
			Ampicillin	1 (0.1)
			Piperacillin	1 (0.1)
	Antiamoebic drugs	3 (0.3%)	Metronidazole	3 (0.3)
	Fluoroquinolones	2 (0.2%)	Ciprofloxacin	2 (0.2)
	Miscellaneous antibiotics	1 (0.1%)	Vancomycin	1 (0.1)
Department of Orthopaedics	Cephalosporins	52 (5.5%)	Cefuroxime	30 (3.1)
			Cefoperazone	14 (1.5)
			Ceftriaxone	5 (0.5)
			Cefotaxime	3 (0.3)
	Beta-lactamase inhibitors	19 (2%)	Sulbactam	14 (1.5)
			Clavulanic acid	3 (0.3)
			Tazobactam	2 (0.2)
	Aminoglycosides	15 (1.6%)	Amikacin	10 (1)
			Gentamicin	5 (0.5)
	Penicillins	6 (0.6%)	Amoxycillin	2 (0.2)
			Piperacillin	2 (0.2)
			Cloxacillin	2 (0.2)
	Antiamoebic drugs	4 (0.4%)	Metronidazole	4 (0.4)
	Fluoroquinolones	2 (0.2%)	Ciprofloxacin	2 (0.2)
Department of Paediatrics	Cephalosporins	28 (2.9%)	Ceftriaxone	14 (1.5)
			Cefotaxime	13 (1.4)
			Cefuroxime	1 (0.1)
	Penicillins	19 (2%)	Ampicillin	11 (1.2)
			Amoxycillin	3 (0.3)
			Cloxacillin	2 (0.2)
			Crystalline penicillin	2 (0.2)
			Piperacillin	1 (0.1)
	Aminoglycosides	10 (1%)	Amikacin	8 (0.8)
			Gentamicin	2 (0.2)
	Beta-lactamase inhibitors	3 (0.3%)	Clavulanic acid	2 (0.2)
			Tazobactam	1 (0.1)
	Antiviral drugs	3 (0.3%)	Acyclovir	2 (0.2)
			Oseltamivir	1 (0.1)
	Macrolides	1 (0.1%)	Azithromycin	1 (0.1)
	Antiamoebic drugs	1 (0.1%)	Metronidazole	1 (0.1)

[Table/Fig-7]: Commonly prescribed antibiotics department-wise.

The values of WHO prescribing indicators of antibiotic use in this study, along with the standard values, are described in [Table/Fig-8] [16].

Parameter	Obtained value	Standard WHO value [16]
The average number of antibiotics per encounter	1.61	<2
Percentage of antibiotic encounter	49.7%	<30%
Percentage of antibiotic injections encountered	66.7%	<20%
Percentage of antibiotics prescribed as generics	29%	100%
Percentage of antibiotics prescribed from NLEM	88.28%	100%

[Table/Fig-8]: Analysis of WHO prescribing indicators [16].

DISCUSSION

In this study, 1,186 medical records were analysed, among which 589 were prescribed antibiotics. Among the medical records with antibiotics, 40.7% were male patients, and 59.3% were female patients. The gender distribution was similar to the studies conducted by Raj Shivaani MR and Selva P (males-38% and females-62%) and Ahiabu MA et al., (Males-39.1% and females-60.9%), where also females contributed more percentage [1,12]. The higher number of females can be explained by the more number of records analysed from the Department of Obstetrics and Gynaecology. In the study, the antibiotic prescription was more in the age group 21-40 years (37.9%) and less in the age group >60 years (19.3%). The inclusion of higher number of females of reproductive age group, again can be the reason for higher antibiotic prescription rate in the age group 21-60 years. Out of the 589 records with antibiotics, 38.2% consisted of multiple antibiotics. The use of FDCs {98 out of 225 (43.6%)} can explain this higher percentage of use of multiple antibiotics. This was similar to the studies conducted by Demoz GT et al., (39%) and Mani S and Hariharan TS (36%) [6,17].

This study found that 64.8% antibiotics were parenteral, 34.2% were oral, and 1% was topical antibiotics. The percentage of parenteral antibiotics was similar to that in the study conducted by Remesh A et al., (60%) [18]. Some studies, Demoz GT et al., (84.8%) and Amaha ND et al., (81.4%), reported significantly higher parenteral antibiotic prescriptions than these [6,19]. These studies were conducted in referral hospital [19] and comprehensive specialised hospital [6], where severity of illness would be higher, which could explain the higher parenteral antibiotic prescription. Various studies, Raj Shivaani MR and Selva P (26.48%), Ahiabu MA et al., (22.9%) respectively, revealed fewer parenteral antibiotic prescriptions, which is in par with the WHO prescription guidelines [1,12]. The frequently prescribed antibiotic group in this study were cephalosporins (34.5%), followed by penicillins (24%), which corresponds to the results in the recent studies conducted by Jokandan SS and Jha DK (Cephalosporins 22.03%) and Farooqui HH et al., (Cephalosporins 38.3% and Penicillins 22.8%) [20,21]. Betalactams antibiotics (60.2%) were the most common pharmacological class of drugs prescribed in the study done by Mani S and Hariharan TS (20%) and Remesh A et al., (60.2%) [17,18]. In this study, the most commonly prescribed antibiotic was cefotaxime (15.3%), followed by amoxycillin (13.8%). The newer reserve antibiotics like linezolid, meropenem so on were prescribed very little. Cefixime (8.09%) was most prescribed in the study done by Jokandan SS et al., whereas ceftriaxone (24.5%) was most prescribed in the study conducted by Demoz GT et al., [6,20]. In common, cephalosporins were the commonly prescribed group of antibiotics and the individual drugs varies according to variations in regional microbial susceptibility.

Various parameters of WHO core prescribing indicators were analysed in this study and compared with similar studies [16]. The first parameter was the average number of drugs per encounter which was 1.61 in this study. The standard value proposed by WHO in this regard is <2, which was very well satisfied in this study. Higher values were obtained in other studies like Raj Shivaani MR and Selva P; Demoz GT et al., Ahiabu MA et al., and Remesh A et al., [1,6,12,18].

The second parameter was the percentage of drugs prescribed with the generic name, 29% in this study. This was a lower than the standard WHO value of 100%. The physicians must be made aware in this regard. This value was higher than that obtained in the study by Remesh A et al., [18]. Nevertheless, several studies report significantly higher percentages of generic name usage in antibiotic prescriptions [Table/Fig-9] [1,6,12,12,17-21].

The percentage of prescriptions with antibiotics in this study was 49.7% which was a higher value than the standard value, which is

Author	Region	Publication year	Study population	Medical records with antibiotics	% Multiple antibiotics	Frequently prescribed antibiotic group	Frequently prescribed antibiotic	WHO prescribing indicators				
								Drugs/ Encounter	% Generic name	% Medical records with antibiotics	% Antibiotic injections	% NLEM adherence
Present study	Kerala, India	2022	Inpatients	589	Single: 61.8% Multiple: 38.2%	Cephalosporins (34.6%)	Cefotaxime (15.3%)	1.61	29%	49.7%	66.7%	88.28%
Raj Shivaani MR and Selva P [1]	Tamil Nadu, India	2020	Inpatients	400				3.6	36.2%		26.48%	92%
Demoz GT et al., [6]	Ethiopia	2020	Inpatients	822	Single: 49% Multiple: 39%		Ceftriaxone (24.5%)	2.01	97.6%	52.3%	84.8%	
Ahiabu MA et al., [12]	Ghana	2016	Outpatients	1600			Amoxycillin (26.7%)	4.01	79.2%	59.9%	22.9%	88.1%
Mani S and Hariharan TS [17]	Kerala, India	2017	Outpatients and inpatients	610	Single: 64% Multiple: 36%	Penicillins (20%)	Ampicillin		31%	29%	48%	69%
Remesh A et al., [18]	Kerala, India	2013	Inpatients	100		Cephalosporins (51.7%)		4.1	10.5%		60%	81%
Amaha ND et al., [19]	Eritrea	2018	Inpatients	100	Single: 77% Multiple: 23%		Ampicillin (42.1%)	1.29	97%	79%	81.4%	100%

Jokandan SS and Jha DK [20]	Karna-taka, India	2019	Outpatients and inpatients	300	Single: 55% Multiple: 45%	Cephalosporins (22.03%)	Cefixime (8.09%)					
Farooqui HH et al., [21]	India	2019	Outpatients	519 million		Cephalosporins (38.3%)						

[Table/Fig-9]: An overview of few studies on antibiotic prescription pattern [1,6,12,12,17-21].

<30%. A lower value was found in the study conducted by Mani S and Hariharan TS [17]. This study was conducted in a tertiary care teaching hospital that primarily handles serious infections which are referred from lower centers. This can be the reason why the antibiotic prescription percentage in hospital is on the higher side.

The fourth parameter was the percentage of injections encountered. The percentage obtained in this study was 66.7% higher than the standard WHO value which was <20%. This can be justified because the study population in this study were inpatients. Most of the cases handled by this institution were surgical procedures and serious infections which require parenteral dosage forms. The studies which were done in outpatients showed lower percentages [1,12,17]. The value obtained in this study (66.7%) was comparable to the value obtained in the study done by Remesh A et al., who also studied antibiotic prescribing patterns in the inpatients [18]. Raj Shivaani MR and Selva P, who studied inpatients, had a lower value [1]. The last parameter was the percentage of drugs prescribed from the NLEM was 88.28% in this study. This was higher than the values obtained in other studies [Table/Fig-9].

The percentage of the rationality of prescriptions and the reasons for irrationality were not much discussed in previous studies. In this study, 520 of the 589 records with antibiotics were rational prescriptions adhering to NLEM. An 11.7% were irrational prescriptions, and the most frequent reason for irrationality happened to be the use of multiple antibiotics with the same spectrum of coverage (44.9%). In a study conducted in Bangladesh by Begum T et al., who analysed the rationality of antibiotic prescriptions in admitted patients, 14% were irrational, but the reasons for irrationality were not assessed [22]. A 60% of the prescriptions were found incorrect in the study done by Hadi U et al., where irrationalities in surgical prophylaxis were the main culprit [23]. The findings of this study, which was in par with several previous studies, put forward a foundation on which strong initiatives could be established for promoting rational use of antibiotics. These initiatives can effectively fight antibiotic resistance which is an upcoming danger to the world population.

Limitation(s)

The present institution was a Government medical college, and the prescription pattern depends on the government supply of drugs. In this study, all the clinical departments of institution were not included, especially the super speciality departments.

CONCLUSION(S)

Present study puts forward the trends in the prescription of antibiotics in the inpatients of this institution, from which the rationality of antibiotic use in this hospital could be assessed. According to this study, most of the drugs were prescribed from the NLEM, and cephalosporins were the most commonly used antibiotics for the inpatients in present hospital. Cefotaxime was the most frequently prescribed antibiotic followed by amoxycillin. The use of generic names in the prescriptions was low. Awareness among the physicians must be boosted up in this regard. Irrational prescriptions contributed a minor percentage, and reserve antibiotics were too little. This data can be utilised as a reference scale for measuring and comparing the impact of steps taken to promote rational use of antibiotics. It is suggested that the process of prescription auditing must be enhanced to nullify the upcoming threat of antibiotic resistance. Similar studies must also be encouraged to improve physicians' prescribing habits and practices.

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