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A CROSS-SECTIONAL STUDY ON PRESCRIBING PATTRENS OF ANTIBIOTICS IN INFECTIOUS DISEASES AT A TERITIARY CARE HOSPITAL

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ABSTRACT

Antibiotics are the pillars of modern medical care and play a significant role in the treatment of infectious diseases where it reduced both morbidity and mortality from infections. Inappropriate use of antibiotics may fail to achieve the desired therapeutic outcome, which may result in the development of adverse effects and the emergence of resistance. OBJECTIVES: Assessing the prescribing patterns of antibiotics in infectious diseases and drug use evaluation using WHO prescribing indicators. METHODOLOGY: A prospective observational study carried out in departments of General Medicine, General Surgery and Paediatrics in Sri Venkateshwara Ramnarain Ruia Government General Hospital, a tertiary care hospital in Tirupati, for six months with a sample size of 240. RESULTS: The majority of the patients prone to infectious diseases (27%) were in the age group of 1-10 years, males were more prone (62.5%). Most commonly affected system was gastrointestinal and respiratory system (23.3%). Among 398 antibiotic drugs, Cephalosporins (38.4%) are the most prescribed category of the drug. Among 240 prescriptions, 65 prescriptions have drug interactions, and five patients reported adverse drug reactions. An average of 5.86 drugs prescribed per patient encounter, the percentage of meetings with antibiotics was 57.8%, generic names prescribed were 28.26% and 99.2% antibiotics were prescribed from EDL which shows deviations from standard WHO indicators. CONCLUSION: Prescription patterns and usage of antibiotics in this study was inappropriate in the comparison of results with WHO prescribing indicators. Effective interventions are required to reduce inappropriate antibiotic prescriptions.

Key words: Antibiotics, Infectious diseases, EDL, WHO prescribing indicators.

INTRODUCTION

Many organisms live in and on our bodies. They are generally harmless or even helpful. But under certain conditions, some organisms may cause diseases. Those diseases are called infectious diseases. Infectious diseases are disorders caused by organisms-such as bacteria, viruses, fungi or parasites. Infectious diseases are contagious, meaning they can spread from person to person. Some infectious diseases can be passed from animals or insects to humans, but not from person to person; for example, HIV is both irresistible and contagious [1].

Irrationality in Prescriptions

Excess of drug utilization studies focused on assessing patterns of drug prescribing as a mean of pinpointing areas for improvement to rationalize drug use.

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The health threats that can be caused by improper prescribing cannot be overlooked [2]. Incorrect prescribing can cause toxicity for patients and will be a waste of money and time [3]. It can also cause therapeutic failure that results in progress of disease condition and worsening of the patient health condition. The improper prescribing and excessive use of antibiotics can lead to loss of the effectiveness of currently used antibiotics [4]. Antibiotic usage has reduced both morbidity and mortality from infection & also served as prophylaxis for infections. Though antibiotic therapy is a tremendous success, its emerging resistance is one of the significant issues in the health care system. Its prevalence is well documented in most of Europe, part of Asia & Africa & alarming in some places [5].

It's a financial and economic burden on the medical community. Total health care costs estimated in the U.S was up to $55 billion, out of which 2/3 contributed to the loss of productivity. In Europe, out of 1.5 billion,>900 was due to hospital costs, whereas loss of productivity contributed to 40%. According to a study on "antimicrobial resistance in Asia", hospital-acquired infections are higher compared to community-acquired diseases in India, especially in China, where antibiotic consumption is 80% for hospital inpatients. According to the CDC, in 2013, each year, at least 2 million people die directly due to antibiotic-resistant infection [6].

The World Health Organisation (WHO) strategy defines that the appropriate use of antibiotics as the cost-effective use of antibiotics which maximizes the clinical therapeutic effect and minimizes the drug-related toxicity and development of resistance, where the failure in these factors may result in the irrational use of antibiotics. Rational use of antibiotics is essential, as antibiotic resistance is not only a problem for the individual patient but also reduces the effectiveness of established treatment and has become a significant threat to public health by increasing complexity, cost of treatment and reducing the probability of successful outcome [7].

Resistance of Antibiotics

Inappropriate use of antibiotics may fail to achieve the desired therapeutic outcome, which may result in the emergence of resistance. Resistance to the antibiotics is a natural biological phenomenon. With the widespread use of antibiotics, the prevalence of the strength of drugs was increased to each new drug in recent days. Bacterial resistance is so broad and fatally dangerous that it has become a global problem that presents a therapeutic dilemma to the health care professionals [8].

Poor infection control practices, negligent antibiotic use and the consistent dismissal of warnings against antibiotics often result in a condition where the body becomes more vulnerable to diseases. Thentreatment becomes difficult as the pathogens develop resistance against antibiotics drugs that are administered more often than required [9].

Studies report that the recent use of antibiotics in primary care as the most critical risk factor for resistance development. The resistance has become a major global threat over the past years, which alarms the world health organization to declare opposition as a worldwide crisis [10]. Bacteria are gaining resistance due to mutations. Associated with life-threatening conditions through adverse effects and adverse drug reaction development, development of tolerance and resistance to certain drugs like antibiotics [11].

There is a need to understand better and characterize the epidemiology of the antimicrobial resistance since it varies with host, antibiotic and pathogen factors. This is necessary to prevent treatment failure, which might be the representative of antimicrobial resistance. This is not simple because of the availability of a large number of antibiotics, varying strains of infectious agents and microbial characteristics and difficulty in identifying and reporting the adverse events among the population [12]. Bacteria may develop cross-resistance to other antibiotics leading to the development of multidrug resistance. Dissemination of such antibiotic – resistance bacteria is making this issue a global threat.

DUR Is Classified In Three Categories [13]:

PROSPECTIVE: Evaluation of a patients drug therapy before medication is dispensed

CONCURRENT: Ongoing monitoring of drug therapy during treatment

RETROSPECTIVE: Review of drug therapy after the patient has received the medication

Issues Commonly Addressed by the Types of DUR:

Clinical abuse/misuse
Drug disease contraindications
Drug dosage modification
Drug-drug interactions (when two or more different drugs interact and alter their intended effects, often causing adverse events)
Drug patient precautions (due to age, allergies, gender, pregnancy, etc.)
Formulary substitutions
Inappropriate duration of drug treatment
Inappropriate duration of treatment
Incorrect drug dosage
Use of formulary medications whenever appropriate
Therapeutic appropriateness and or duplication

WHO Prescribing Indicators

The indicators of prescribing practices measure the performance of health care providers in several key dimensions related to the appropriate use of drugs. The indicators are based on the practices observed in a sample

of clinical encounters taking place at outpatient health facilities for the treatment of acute or chronic illness. These encounters can be seen retrospectively, from data recorded in historical medical records, or they can be followed prospectively.

The main aim of studying of prescription pattern infers to monitor, evaluate, and suggest modifications in the practitioners' prescription habits, to make patient care reasonable and adequate. The knowledge about antibiotic patterns is necessary for a constructive approach to problems that arise from multiple antibiotic usages.

Through prescribing patterns, we are evaluating prescription having antibiotics, identifying adverse drug reactions, drug interactions and medication errors of antibiotics to avoid misuse or irrational use of antibiotics in infectious diseases.

AIM

The main aim of our study is to analyse the prescribing patterns of antibiotics in infectious diseases at a tertiary care hospital.

OBJECTIVES

Assessment of drug utilization patterns of antibiotics. To assess drug use evaluation using WHO prescribing indicators. Identification of drug-drug interactions. To assess adverse drug reactions. Identification and reporting of medication errors related to antibiotics.

RESULTS

Out of 240 patients, highest no of patients were under the age group of 1-10(27%) years followed by 51-60Y, the lowest no of patients were under the age group of 81-90years (1.25%) respectively (Fig No.1). Out of 240 patients, highest no of patients were males 150 (62.5%) followed by females (37.5%) respectively (Fig No 2). Out of 240 patients, highest length of hospital stay is 2-4 days that is 105 (43.70%) and the lowest length of hospital stay is 17-19 days that is 1 (0.4%) (Fig No 3). Out of 240 patients, highest no of patients were under paediatrics that is 99 (41.25%) followed by general surgery that is 77 (32%) and general medicine that is 66 (26.6%) respectively (Fig No 4). Out of 240 patients, the highest number of diseases are Gastrointestinal and Respiratory disorders that are 56 (23.3%), where the lowest quantity of illnesses seen in nervous system disorders that is 13 (5.41%) and other diseases respectively (Fig No 5). In a total of 240 prescriptions, a total number of 1408 drugs were given where the number of antibiotics prescribed is 398(28%), and the other medicines are 1010 (72%) respectively (Fig No 6). Out of 240 prescriptions, the highest number of drugs given per prescription are five drugs 57 (23.5%) followed by 6 drugs per prescription 41 (17.0%), and the lowest drugs given per prescription are one drug of 2 (0.83%) (Fig No 7). Out of 398 antibiotics, the highest number of drugs prescribed per prescription is one drug 96 (40%) followed by 5 and 7 drugs 1 (0.4%) respectively (Fig No 8).

Table 1: Average number of drugs per encounter

Purpose	Calculation
To measure the degree of polypharmacy.	Average, calculated by dividing the total number of different drug products prescribed, by the number of encounters surveyed. It is not relevant whether the patient received the drugs.

Table 2: Percentage of drugs prescribed by generic name

Purpose	Calculation
To measure the tendency to prescribe by generic name.	Percentage, calculated by dividing the number of drugs prescribed by generic name by the total number of drugs prescribed, multiplied by 100.

Table 3: Percentage of drugs prescribed from essential drugs list or formulary

Purpose	Calculation
To measure the degree to which practices conform to national drug policy, as indicated by prescribing from the national essential drugs list or formulary for the type of facility surveyed.	Percentage, calculated by dividing the number of products specified which are listed on the essential drugs list or local formulary (or which are equivalent to drugs on the list) by the total number of products specified, multiplied by 100.

Table 4: Antibiotics X Antibiotics

S.No	Drug interaction	Severity	Number	Percentage	Outcome
1	Ciprofloxacin X Metronidazole	Major	19	86.36%	Increase In QT Interval Prolongation
2	Vancomycin X Amikacin	Major	2	9.0%	Additive Ototoxicity
3	Amoxicillin + Clavulanic acid (Amoxiclav) X Gentamicin	Major	1	4.5%	Loss of Aminoglycoside Efficacy
		Total	22	100%	

Table 5: Antibiotics X Others

S.No	Drug interaction	Severity	Number	Percentage	Outcome
1	Ciprofloxacin X Octreotide	Major	1	2.32%	QT-Interval Prolongation
2	Metronidazole X Octreotide	Moderate	5	11.62%	QT-Interval Prolongation
3	Ciprofloxacin X Diclofenac	Moderate	2	4.56%	Increased Ciprofloxacin Plasma Concentrations
4	Amikacin X Mannitol	Major	2	4.65%	Alteration of Serum and Tissue Amikacin Concentration
5	Azithromycin X Fluconazole	Moderate	2	4.65%	QT-Interval Prolongation
6	Metronidazole X Ondansetron	Minor	2	4.65%	QT-Interval Prolongation
7	Ciprofloxacin X Human Mixtard	Minor	2	4.65%	Increased Risk of Hypoglycemia
8	Ciprofloxacin X Sucralfate	Moderate	2	4.65%	Decreased Oral Ciprofloxacin Effectiveness
9	Ciprofloxacin X Ondansetron	Minor	1	2.32%	QT-Interval Prolongation
10	Norfloxacin X Fluconazole	Moderate	1	2.32%	QT-Interval Prolongation
11	Azithromycin X Ondansetron	Minor	1	2.32%	QT-Interval Prolongation
12	Cephalexin X Furosemide	Minor	1	2.32%	Increased Risk of Renal Damage
13	Doxycycline X Plain Insulin	Minor	1	2.32%	Increased Hypoglycemia
14	Azithromycin X Tramadol	Minor	1	2.32%	QT-Interval Prolongation

Table 6: List of Adverse Drug Reactions

S.No	Drug Involved	ADR	Severity	Score(Naranjo)	Number
1	Ciprofloxacin	Vomiting	Probable	5	2
2	Azithromycin	Fever	Probable	5	2
3	Amoxicillin + Clavulanic acid (Amoxiclav)	Rashes	Probable	8	1

Table 7: WHO Prescribing Indicators

S.No	WHO Prescribing Indicator	Average/ Percentage	WHO Standard (%)
1	Average number of drugs per encounter	5.86	2
2	Percentage of encounters with one or more antibiotics	57.8	20-26.8
3	Percentage of drugs prescribed by generic name	28.26	100
4	Percentage of antibiotics from essential drug formulary list	99.2	100

Table 8: Resistance Antibiotics

S.No	Antibiotics	Test done	Outcome
1	Amoxicillin + Clavulanic acid (Amoxiclav)	Sensitivity test	Drug continued
2	Piperacillin + Tazobactum	Sensitivity test	Drug discontinued and alternative treatment has been provided

Fig No 1: Age-wise distribution

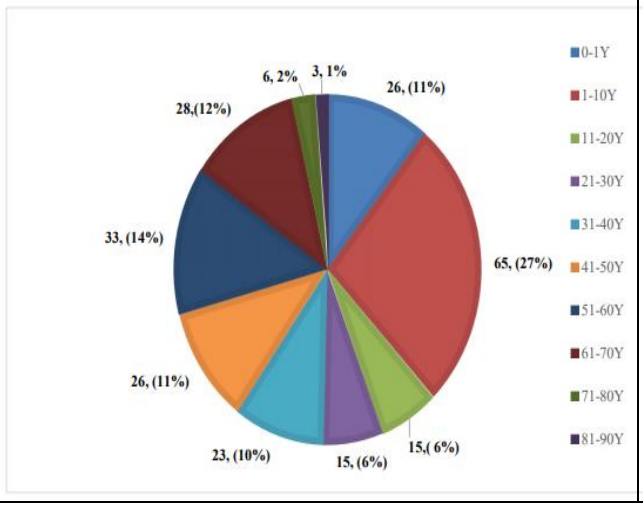


Fig No 2: Gender wise distribution

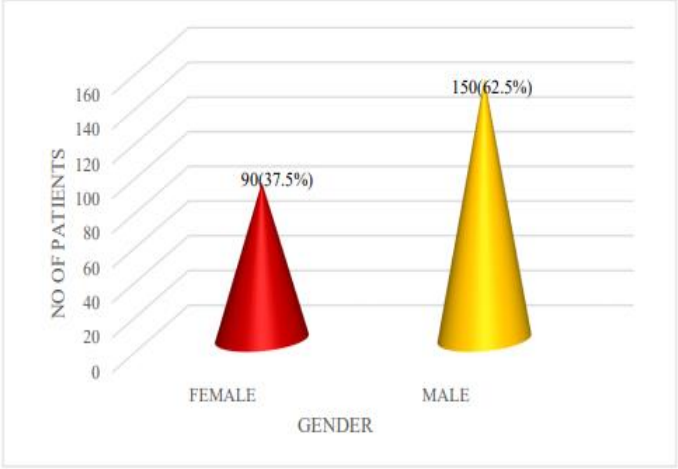


Fig No 3: Duration of hospital stay

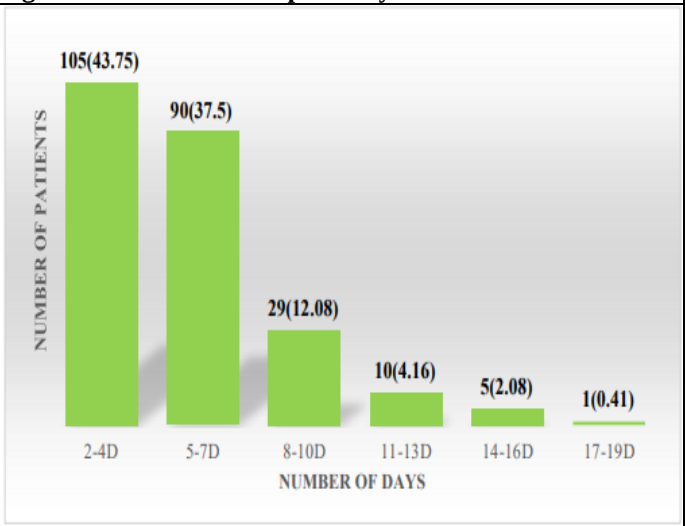


Fig No 4: Department wise distribution

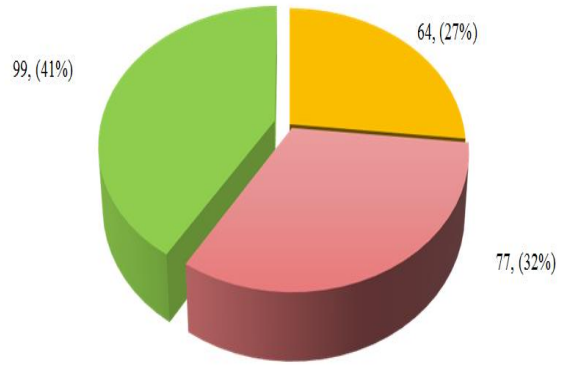


Fig No 5: Diagnosis distribution in infectious diseases

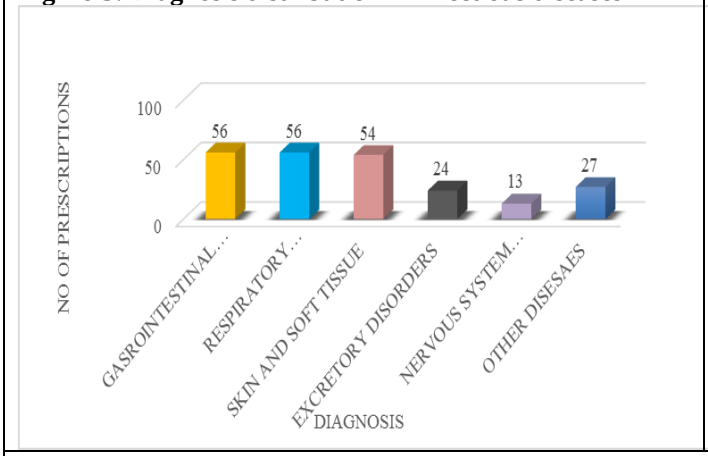


Fig No 6: Distribution of drugs

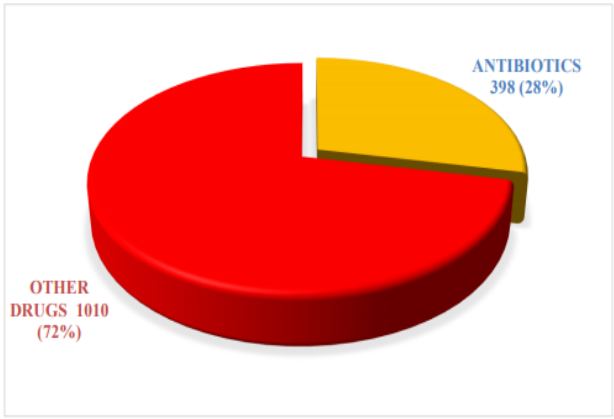


Fig No 7: Number of drugs given per prescription

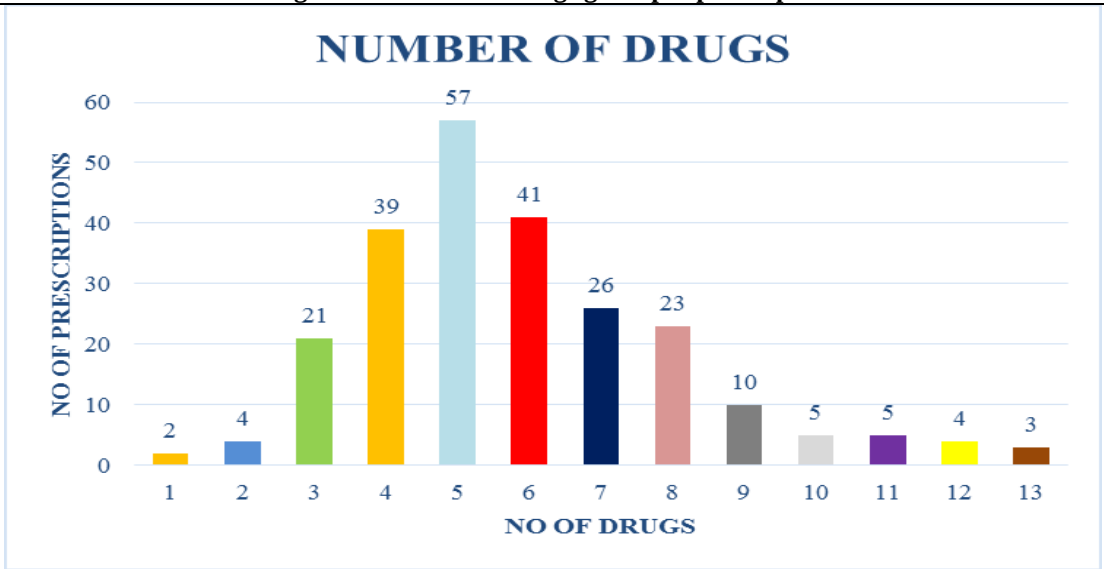


Fig No 8: No of antibiotics given per prescription

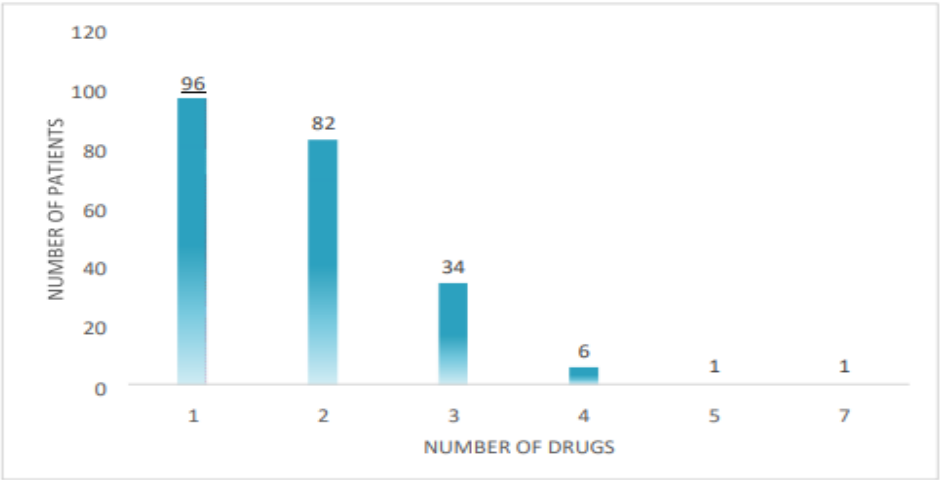


Fig No 9: List of antibiotics

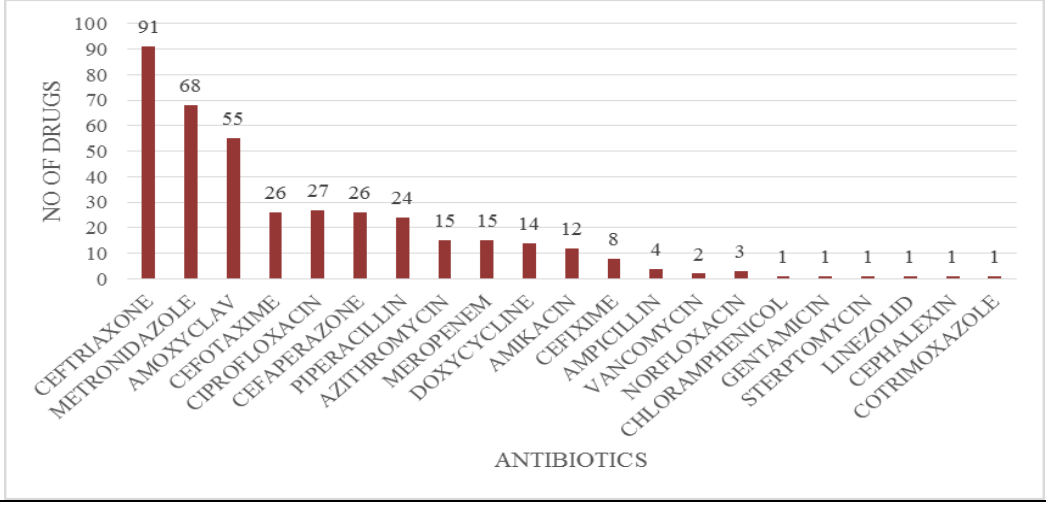


Fig No 10: Category wise antibiotics

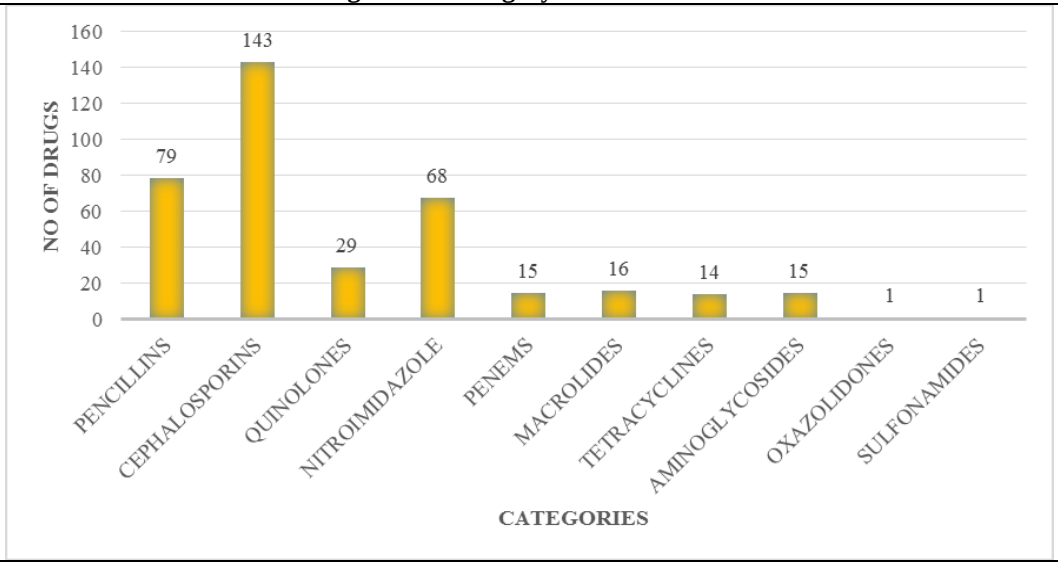


Fig No 11: Cephalosporin antibiotics

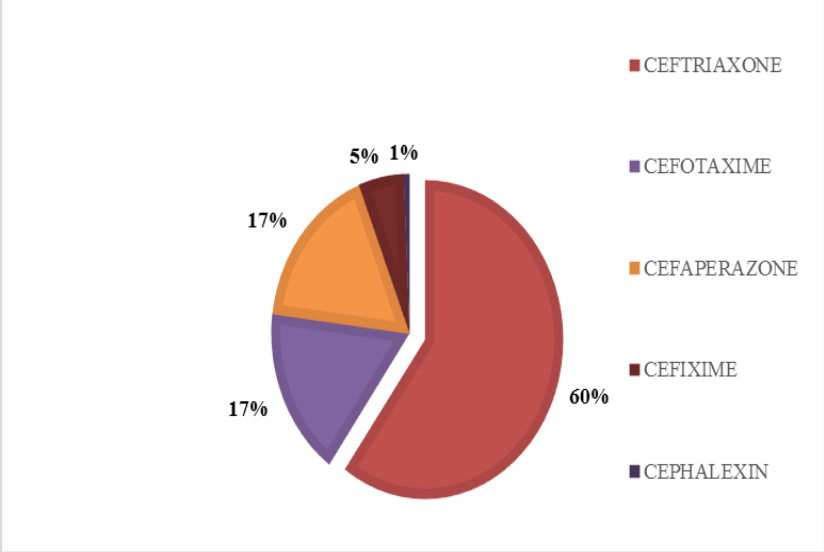


Fig No 12: Penicillin antibiotics

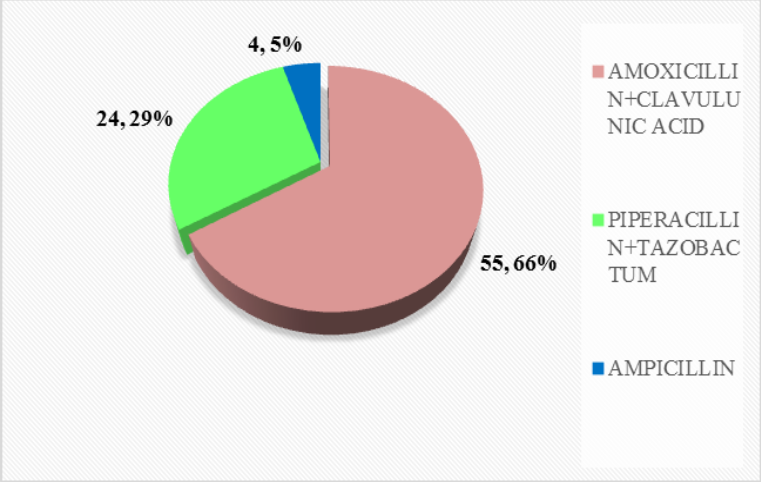


Fig No 13: Fluoroquinolone antibiotics

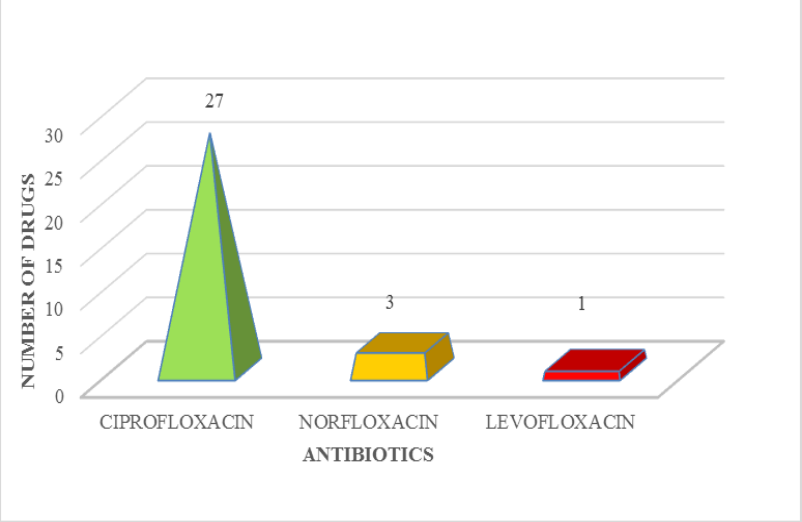


Fig No 14: Macrolide antibiotics

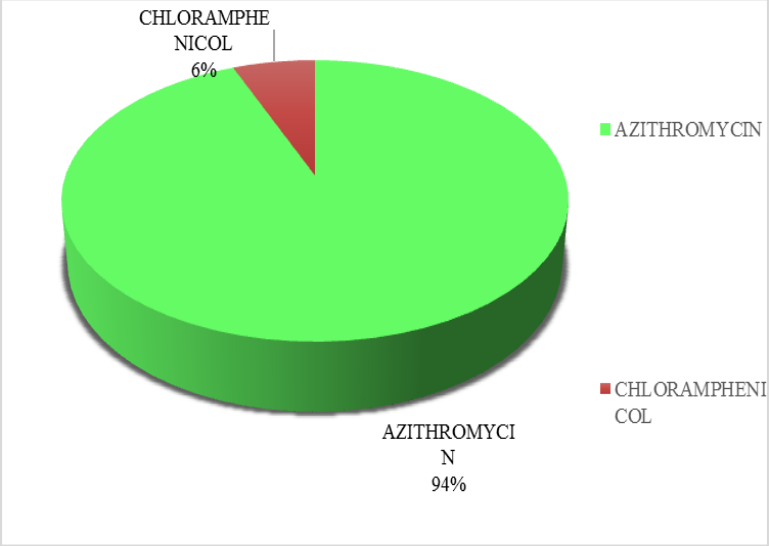


Fig No 15: Aminoglycoside antibiotics

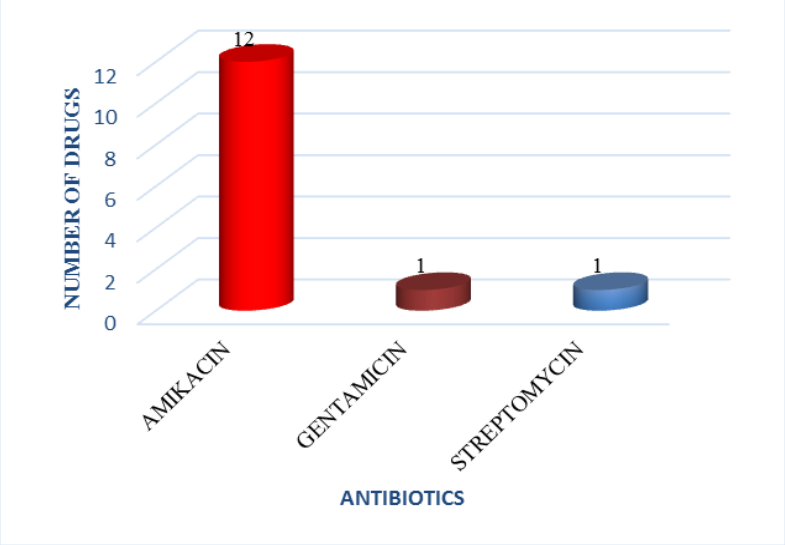


Fig No 16: Other antibiotics

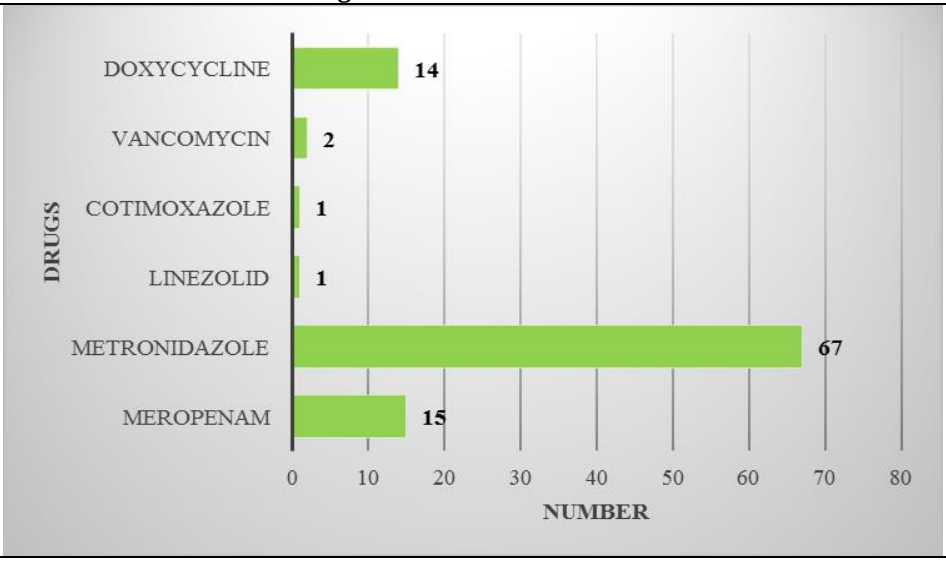


Fig No 17 : List of brand and generic drugs

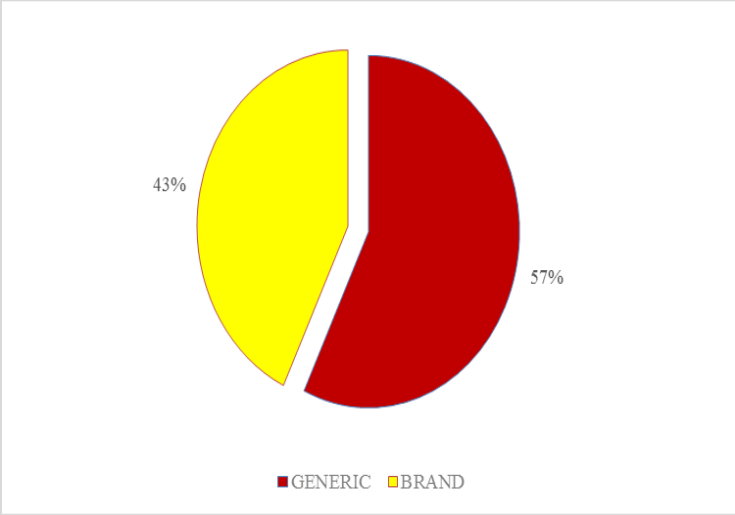


Fig No 18: Number of generic drugs

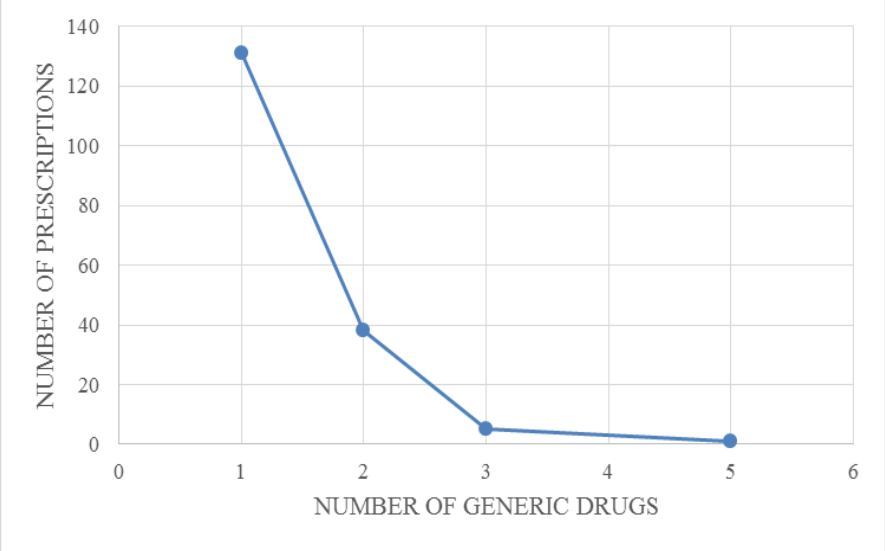


Fig No 19: Number of brand drugs

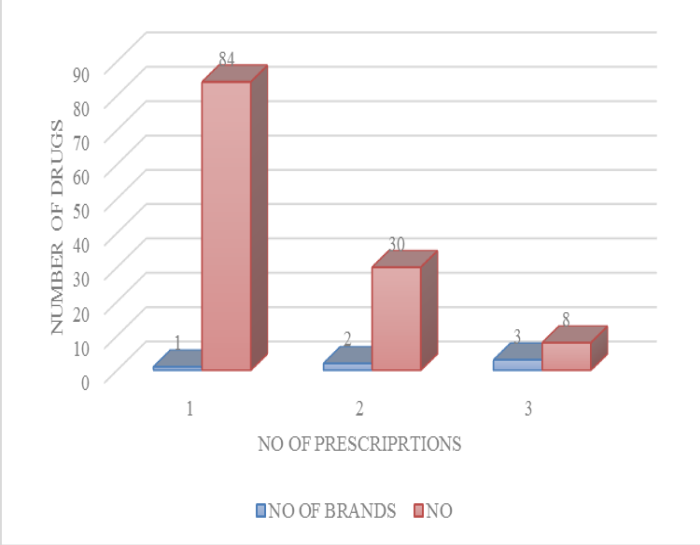


Fig No 20: Route of administration

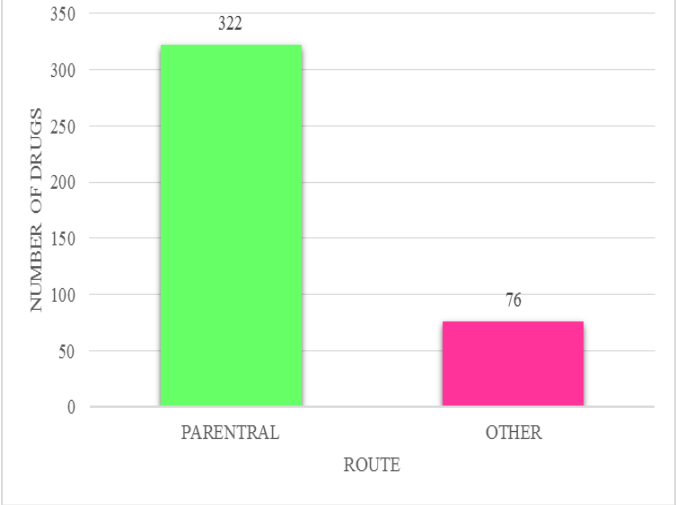


Fig No 21: Type of drug interactions

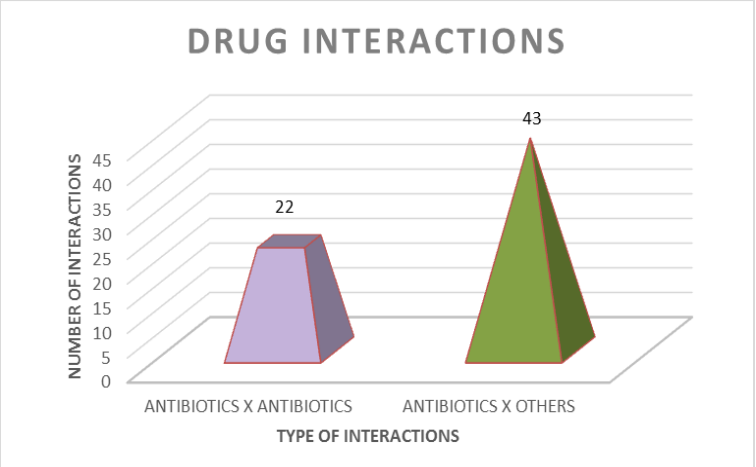
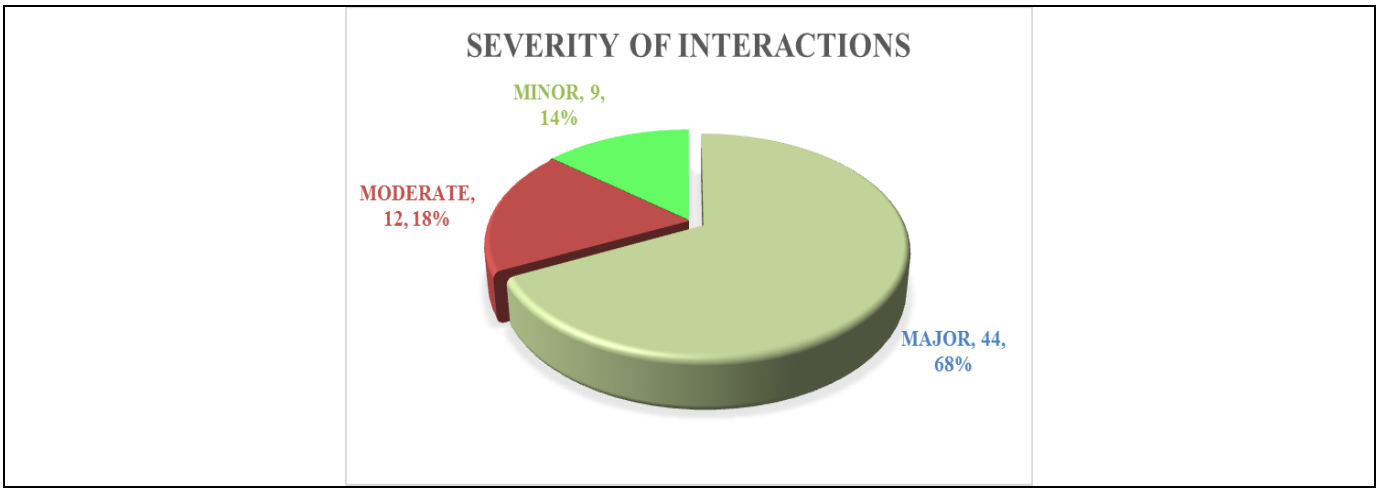


Fig No 22: Severity of drug interactions



Out of 398 antibiotics, the most commonly used medicine is ceftriaxone that is 91 (22.8%) and the least used was cotrimoxazole, cephalexin, etc., that is 1 (0.25%) (Fig No 9). In 398 the highest number of antibiotics are given from cephalosporin category that is 143 (36.10%), and the least amount of medicines are prescribed from sulphonamides and oxazolidones that is 1 (0.25%) respectively (Fig No 10). Out of 153 cephalosporins, the highest prescribed cephalosporin is ceftriaxone 91 (59.4%) followed by cefotaxime and cefoperazone 26 (16.9%), and the least prescribed was cephalexin 1 (0.65%) respectively (Fig No 11). Out of 83 penicillin antibiotics, the most prescribed penicillin antibiotics was amoxicillin+ clavulanic acid that is 55 (66.26%), and the lowest prescribed medicine was ampicillin that is 4 (4.8%) respectively (Fig No 12). Out of 31 fluoroquinolones, the most prescribed antibiotic is ciprofloxacin that is 27 (87.0%), and the least prescribed medicine was levofloxacin is 1 (3.2%) respectively (Fig No 13). Out of 16 macrolide antibiotics, the most prescribed medicine was azithromycin that is 15 (93.7%) followed by chloramphenicol is 1 (6.3%) (Fig No 14).

Out of 14 aminoglycosides, the most prescribed aminoglycoside was amikacin that is 12 (85.71%) followed by gentamicin and streptomycin that is 1 (7.14%) respectively (Fig No 15). Out of 100 0ther types of antibiotics metronidazole used in 67 (67%) patients followed by doxycycline 14 (14%), meropenem 15 (15%), vancomycin 2 (2%), cotrimoxazole and linezolid 1 (1%) respectively (Fig No 16). Out of 398 antibiotics the highest number of medicines are prescribed by generic name that is 227 (57.03%), and the antibiotics are given through brand name is that is 171 (42.97%) respectively (Fig No 17). Out of 227 generic antibiotics, the most generic drugs given per prescription are one drug that is 131 (57.7%) followed by two drugs per prescription that is 40 (35.24%) and lowest generic drugs given per prescription are five drugs is 1 (2.2%) (Fig No 18). Out of 171 brand antibiotics, the most brand-name drugs are given per prescription is one drug that is 84 (49.12%) followed by two drugs per prescription that is 30 (35.24%) (Fig No 19). Lowest brand drugs are given per prescription are three medications that is 8 (2.2%), respectively. Out of 398 antibiotic drugs, 322 (80.98%) given through parenteral route and 76 (19.02%) drugs were given in other courses respectively (Fig No 20). Out of 65 drug interactions, the Antibiotic with Antibiotics were found to be 22 (33.8%) and Antibiotics with Other communications were found to be 43 (66.2%) (Fig No 21). Out of 65 drug interactions, the mostly seen drug interactions are primary major 44 (68%) followed by moderate 12 (18%) and minor 9 (14%) respectively (Fig No 22).

DISCUSSION

In the present study a total of 240 inpatients diagnosed by infectious diseases were considered in this study where the highest number of diseased population was seen in the age group of 1-10 years were 65 (27%) followed by 51-60 years were 33 (13.75%) followed by 61-70 years were 28 (11.6%) followed by 0-1 years and 41-50 years were 26 (10.8%) followed by 31-40 years were 23 (9.5%) followed by 11-20 years and 21-30 years were 15 (6.25%) followed by 71-80 years were 6 (2.5%) followed by 81-90 years were 3(1.25%) respectively which were similar to G.Sireesha et.al.[5]

In the present study, 57 (23.75%) of patients were prescribed with 5 drugs per prescription, 39 (16.25%) with 4 drugs per prescription and 2 (0.83%) of patients were prescribed with 1 medication.

In this study 227 (92.9%) patients out of 240 had received antibiotic treatment for the infections, where 40% patients of them received one antibiotic followed by 82 (34.1%) patients received 2 antibiotics and 1 (0.4%) and 1 (0.4%) patients received 5 and 7 drugs per prescription respectively.

Among ten categories of antibiotics prescribed cephalosporins 153 (36.1%) were the most commonly

prescribed antibiotic, followed by penicillin 85(21.6%) and the least prescribed antibiotic were oxazolidines and sulphonamides 1 (0.25%) and 1(0.25%) respectively, this was because it covers the majority of the suspected micro-organisms.

In a total number of 398 antibiotics, the most prescribed medicine was ceftriaxone 91 (22.8%) followed by metronidazole 67 (16.3%) and amoxicillin + clavulanic acid (Amoxiclav) 57 (14.32%) and the least prescribed antibiotic was linezolid, streptomycin and cotrimoxazole that is 1(0.25%), 1 (0.25%) and 1(0.25%) respectively because ceftriaxone is used to treat many of the infections as it acts as a broad-spectrum antibiotic.

In this study, among ten categories of antibiotics the most prescribed individual medicine in each class was ceftriaxone (cephalosporins) 91, amoxicillin + clavulanic acid (penicillin) were 55, amikacin (aminoglycosides) were 12, ciprofloxacin (fluoroquinolone) was 27, azithromycin (macrolide) was 15, metronidazole (nitroimidazole) was 67, meropenem (carbapenem) were 15 doxycycline (tetracycline) were 14.

The majority of the antibiotics were prescribed through generic name were 227(57.03%), and 171(42.97%) antibiotics were prescribed under the brand name. This was due to the generic prescribing would rationalize the use of drugs and reduce the health care cost with equal potential [14, 15].

In this study, out of 398 antibiotics, 322 (80.92%) were given through parenteral route, 76 (19.08%) were taken through oral route.

In the present study, drug interactions were identified. Out of 240 prescriptions, 65 drug interactions were found where 22 (33.84%) are Antibiotic X Antibiotic interactions, and 43 (66.16%) were Antibiotics X OTHER therapeutic class drugs which were similar to B. Rajalingamet.al. [9]

Drug-drug interactions (DDI) are most commonly seen prescription errors. In a total of 65 drug interactions, significant interactions were 44, followed by moderate were 12, and minor interactions were nine, respectively. All these interactions observed were potential interactions which were not seen in patients. The drug-drug interactions are identified by using Micromedex Solutions-A Truven HealthCare app. Proper management of this is based on the recognition of potential DDIs and consequently taking suitable measures like dose or frequency adjustment and also through the inclusion of protective agents.

In a total of 398 antibiotics 5 Adverse drug reactions were found; they were ciprofloxacin induced vomiting were 2, azithromycin induced fever were two and amoxicillin + clavulanic acid (Amoxiclav) induced rashes was 1, respectively.

In our study, we included WHO prescribing indicators where we compared the observed values with the healthy benefits of WHO prescribing indicators. It shows some values similar to the average costs and some shows deviations, which causes irrationality of prescriptions that lead to the occurrence of medication errors which was identical to the studies done by Anteneh Assefa Desalegnet.al.[16]

In a total of 398 antibiotic drugs, three drugs where having resistance to the micro-organism where 2 of the drugs are continued without changing the therapy and 1 medicine, the treatment was changed**.**

CONCLUSION

Antibiotics are among the class of drugs with the most potential impact on preventable mortality. Antimicrobial resistance is emerging as a complex problem driven by many interconnected factors, especially the use and misuse of antimicrobials. From the present study, the pattern of antibiotic prescriptions was not satisfactory when compared to WHO prescribing indicators where the prescribing practices of antibiotics and generics shown deviation from the standard, by WHO indicators which shows the irrational use of antibiotics. Several activities like standard treatment guidelines, drug information centres, drug use evaluation and affordability of drugs of a good standard, medication compliance programs have proved useful and effective in promoting of rational use of antibiotics. There is ample scope of improving prescribing pattern by keeping several medicines low as possible, prescribing medication by generic name, using drugs appropriately after selecting and consciously keeping the cost of therapy low.

So there is a need to pay special attention by clinical pharmacist together with physicians to work together to establish a rational and practical prescribing protocol to avoid irrational use of Antibiotics.

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