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Drug Utilization Pattern of Ciprofloxacin, Ceftriaxone and Metronidazole in General Medicine Department of a Tertiary Care Hospital

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Abstract

Background: Rational use of antibiotics is crucial to prevent antimicrobial resistance, improve patient outcomes, and reduce healthcare costs. Ciprofloxacin, ceftriaxone, and metronidazole are commonly prescribed antibiotics in the general medicine departments of tertiary care hospitals. Evaluating their utilization patterns helps identify trends, potential misuse, and areas for intervention.

Objective: To assess the drug utilization pattern of ciprofloxacin, ceftriaxone, and metronidazole in the General Medicine Department of a tertiary care hospital.

Methods: A prospective observational study was conducted over a period of 6 months in the General Medicine . Patients receiving at least one of the three study antibiotics were included. Data were collected using a structured data collection form and analyzed for parameters such as demographic details, indication, dosage, route of administration, duration of therapy, and adherence to treatment guidelines.

Results: A total of 100 prescriptions were analyzed. Ceftriaxone was the most commonly prescribed antibiotic, followed by metronidazole and ciprofloxacin Majority of the antibiotics were administered via the parenteral route. The most common indications were respiratory tract infections, gastrointestinal infections, and urinary tract infections. Deviations from standard treatment guidelines were observed in 68% of the prescriptions, highlighting areas of irrational use.

Conclusion: The study revealed a high usage of broad-spectrum antibiotics, with notable instances of irrational prescribing practices. Regular drug utilization reviews and antibiotic stewardship programs are essential to promote rational antibiotic use and curb antimicrobial resistance in hospital settings.

Keywords: Drug utilization, Ciprofloxacin, Ceftriaxone, Metronidazole, Antibiotic stewardship, Tertiary care hospital, Monotherapy, Dual therapy, Multiple therapy, Appropriateness

INTRODUCTION

Drug utilization evaluation is an ongoing, authorized and systematic quality improvement process , which is designed to:

- Review drug use and prescribing pattern .
- Provide feedback of results to clinicians and other relevant groups.

- Develop criteria and standards which describe optimal drug use .
- Promote appropriate drug use through education and other interventions .

Drug utilization evaluation is a discipline that aims to understand how and why drugs are used as they are ,so that drug use and health outcomes can be improved . DUE can play a key role in helping the health care system understand ,interpret and improve the prescribing ,administration and use of medications .DUE information may assist health care systems and hospitals to design educational programmes that may improve prescribing and drug use . Some DUE programmes may provide physicians with feedback on their performance and prescribing patterns compared to predetermined criteria or treatment protocols. DUE information may also allow physicians to compare their approach to treat certain diseases with their peers. The " Peer pressure" generated by these comparisions may be useful in motivating physicians to change their prescribing habits in an effort to improve care.

TYPES OF DUE:

DUE studies are often drug focused, where the use of a single drug or class of drugs is examined. Less commonly, DUE studies are indication – focused , where the use of drug or drugs for a specific indication is examined.

DUE studies have also been described as quantitative or qualitative. Qualitative studies involved the collection, organization and display of estimates or measurements of drug use. This type of data is often used for making purchasing decisions or other financial activities such as preparing drug budgets. However,
data from quantitative drug use reviews should generally be considered suggestive, but not conclusive, with respect to quality of use.

Quantitative DUE studies may or may not be an ongoing activity and are almost always a unilateral pharmacy function.

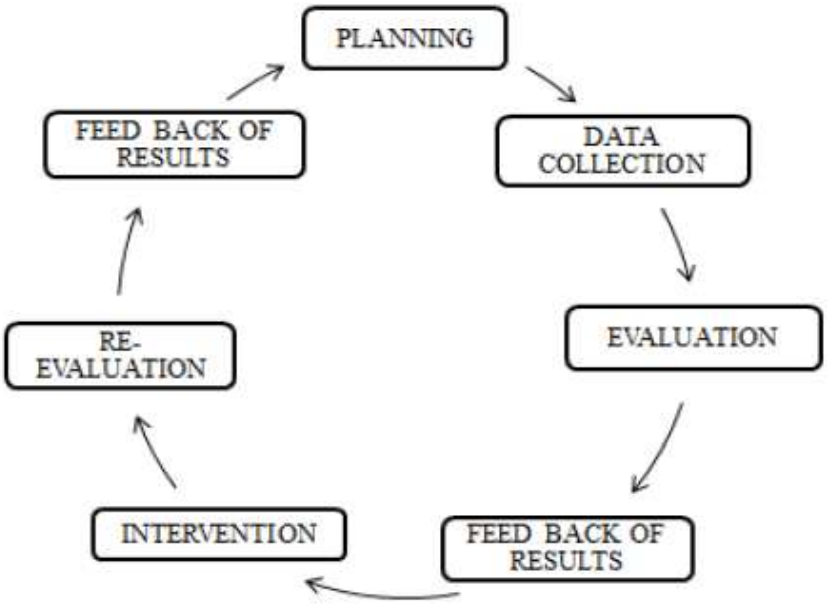
Qualitative DUE studies, on the other hand, are multidisciplinary operations, which collect, organize, analyse and report information of actual drug use. They are usually one-off examinations of narrowly defined areas of drug use, usually specific drugs or specific conditions. The main differences between qualitative and quantitative DUE studies is that qualitative DUE includes the concept of criteria. Criteria are the predetermined elements against which aspects of quality, medical, necessity and appropriateness of medical care may be compared. Drug use criteria may be based on such items as indications for use, dose, dosing frequency and duration of therapy.

It is possible to combine both qualitative and quantitative DUE studies in a single study, which yields information about the patterns and among as well as the quality of drug use.

DUE CYCLE:

It is important to keep in mind that DUE operates in a repeating cycle . The DUE process is a continuous one and will be most valuable if the cycle is completed rather than performing different steps in isolation. The DUE cycle should include the following seven major activities or phases:

I. Planning
II. Data collection
III. Evaluation
IV. Feed back of results
V. Interventions
VI. Re-evaluation
VII. Feedback of results



STEPS INVOLVED IN CONDUCTING A DUE:

STEP 1: IDENTIFY DRUGS OR THERAPEUTIC AREAS OF PRACTICE FOR POSSIBLE INCLUSION IN THE PROGRAMME.

It is not possible and also unnecessary to examine and evaluate every drug used in a hospital. Hence, the DUE Committee must identify priority drugs or areas of practice where improvement in use will result in the greatest clinical impact. These areas can be identified through various sources of information, such as medication error reports, adverse drug reaction reports, feedback from prescribers or clinical pharmacists, local microbiological data and the medical and pharmaceutical literature. ABC/VEN analysis is another important tool used to identify high priority or target drugs. ABC analysis divides the drugs into three classes based on their annual usage:

• Class A drugs constitute 75-80% of the total value of drugs purchased or consumed and are the highest cost or highest volume items.

• Class B items constitute 15-20% of expenditure.

• Class C includes low cost or low volume items, which form 5-10% of expenditure. ABC analysis helps to prioritise drugs for inclusion in drug evaluation studies.

VEN analysis is generally done to assist the selection of drugs to be included in the hospital formulary.

In VEN analysis, the drugs are generally classified as vital (V), essential (E) and non -essential (N). Based on the VEN analysis, one can identify the drugs that are of priority and require possible inclusion in the programme. DUEs have largely focused on drugs with a high volume of use (such as antibiotics), high cost (such as proton pump inhibitors) or high frequency of adverse drug events (for example, anti-coagulants). DUEs may also focus on areas where drugs are underused, such as with aspirin in patients with diabetes.

Common targets for DUE include:

• Commonly prescribed drugs, such as antibiotics and proton pump inhibitors.

• Drugs associated with potentially significant drug interactions such as warfarin, theophylline, digoxin and phenytoin. Expensive drugs, for example,low molecular weight heparins, broad-spectrum cephalosporins, anti-HIV medications .

• New drugs

• Drugs with a narrow therapeutic index, such as digoxin, phenytoin, cyclosporine, theophylline and zidovudine.

• Drugs which upon withdrawal may cause problems, such as anti-depressants benzodiazepines and anti- convulsants.

• Drugs that frequently cause serious/ significant adverse drug reactions, such as antibiotics, anti-convulsants, anti-coagulants, anaesthetic drugs, non-steroidal anti-inflammatory agents, ACE inhibitors and anti-malarials.

• Drugs used in high-risk patients, such as the elderly, transplant patients, cancer chemotherapy and intensive care patients, neonates or children.
• Drugs used in the management of common conditions, such as chronic pain, respiratory tract infections or urinary tract infections.
• Drugs used in areas of practice which are not well performed, such as the prescribing of antibiotics for surgical prophylaxis.
• Drugs which have been recently added or which are under consideration for addition to the hospital formulary.
•Complex areas of prescribing, such as anti-thrombotic and post-transplantation therapy.

More drugs or practice areas will usually be identified in Step 1 than can be included in a typical one-year DUE cycle.

The final choice will ultimately be determined by evidence of a medication use problem within the institution, the severity of harmful effects resulting from inappropriate drug use, the resources available for criteria development, data collection and evaluation, and the likelihood of interventions being successful in improving drug use.

STEP 2: DESIGN OF STUDY:

A variety of research methods have been used in DUE studies. Observational research methods are more commonly used than experimental methods such as randomised controlled trials. Cross-sectional studies, where drug use is examined at a single point in time, are useful for problem identification. The pre-post design where drug use is examined before and after interventions to improve prescribing is another commonly used observational method. Based on the design of the study, DUE studies may also be categorised as prospective, concurrent or retrospective, depending on the timing of data collection.

Prospective review involves evaluating a patient's planned drug therapy before a medication is administered. Depending on the study design, interventions may be provided if necessary before the patients receive the prescribed drug. Identification of drug-drug interactions is one issue commonly addressed by a prospective DUE.

Concurrent review is performed during the course of treatment and involves the ongoing monitoring of drug therapy. This may involve consideration of laboratory test results and other monitoring data when appropriate, and usually does not offer immediate benefit to the patient. It differs from prospective review in that data collection does not have to occur prior to the administration of a first dose.

This method of data collection is convenient when pharmacists perform a daily review of medication charts as part of routine clinical care. For example, in the setting of a DUE evaluating aminoglycoside dosing, a patient with reduced renal function may be prescribed a high dose of gentamicin, which may be inappropriate for the patient based on the patient's estimated creatinine clearance. The clinical pharmacist identifies the dose as inappropriate during their regular treatment chart review and alerts the prescriber about the problem. During a retrospective DUE, drug therapy, is reviewed after the patient has completed a course of therapy. The patient's medication sheets (including discharge prescriptions) daily progress notes, nursing observation pathology/biochemistry results and therapeutic monitoring results are screen to determine whether drug therapy met pre determined criteria. The main advantage of this method is that prescribers and other are unaware of data collection and result may therefore be less biased. Another advantage is ease of data collection, a records are accessed at the data collector' convenience.

A disadvantage is that some information may be unclear or missing and that reviewed patients do not gain immediate benefit, as interventions are delayed until the intervention phase.

STEP 3: DEFINE CRITERIA AND STANDARDS:

After the DUE target has been selected, it is important to conduct a comprehensive literature review. The extent of work involved in this step depends on what has been done previously, or what is already available; for example, local, reliable and authoritative guidelines, or previous DUE criteria. The steps involved in literature review are:

• Perform an exhaustive literature search for the chosen drug or therapeutic area, using multiple search mechanisms such as medical (Medline, Micromedex, Drugdex, Cochrane Library, Embase) and pharmacy-based systems (IOWA Drug Information Service, International Pharmaceutical Abstracts).
• Assemble full copies (not just the abstracts) of all the relevant original research papers.

• Critically evaluate the studies directly relevant to the chosen drug or therapeutic area. This includes identifying strengths and weaknesses in the study design and deciding whether appropriate conclusions have been made from the data presented.
• Briefly summarise the literature review identifying the 'key' papers in the chosen area and the drug use criteria that can be derived from evidence-based literature.

Criteria are predetermined statements describing optimal drug use, against which the quality of actual drug use is compared. Standards are professionally developed expressions of the range of acceptable variation from a criterion. The concept of standards was introduced to take into account the subjective nature of some aspects of medical practice and unusual clinical circumstances. Standards should also be based on published literature and should describe exceptions when deviation from criteria is acceptable.

Phase I: Planning	
STEP 1	Identify drugs or areas of practice for possible study
STEP 2	Design the study
STEP 3	Define criteria and standards
STEP 4	Design the data collection form
Phase II: Data collection	
STEP 5	Collect data
Phase III: Evaluation	
STEP 6	Collate data and evaluate results
Phase IV: Feedback of results	
STEP 7	Feed results back to clinicians and other hospital staff
Phase V: Interventions	
STEP 8	Develop and implement interventions
Phase VI: Re-evaluation	
STEP 9	Re-evaluate to determine if drug use has improved
STEP 10	Re-assess and revise DUE programme as needed
Phase VII: Feedback of results	
STEP 11	Feed results back to clinicians and other hospital staff

STEP4: DESIGN OF DATA COLLECTION FORM:

For conducting DUE it involves the collection of the data relating to patient demographics, prescriber identification, indication for use, disease severity, dosing data, concurrent use of other antibiotics, allergy history and laboratory results such as serum creatinine, blood urea.

STEP5: DATA COLLECTION:

Data collection should be done in a period likely to be representative of the usual patterns of drug use. For example, a DUE examining the use of prophylactic antibiotics prior to surgery should be done when the usual surgeons are in attendance, taking care to avoid a periodwhen key surgeons are on leave.

STEP6:EVALUATE RESULTS:

The data obtained should be collated using available resources such as spreadsheeting, data basing and word processing. The next step is to summarise the main categories of results and to identify where exactly the data shows deviation from the guidelines and usage criteria that are previously identified.

STEP7:PROVIDE FEEDBACK OF RESULTS:

The success of any DUE strategy depends on feedback of results to prescribers, other hospital staff involved in the study and to administrative heads. The results can also be circulated to hospital staff through newsletters, DUE meetings or the hospital academic meetings.

STEP8: DEVELOP AND IMPLEMENT INTERVENTIONS:

If a drug use problem was identified, the next step is to consider how the problem can be addressed. Educational interventions consist of educational meetings, academic detailing circulation of protocols, feedback of results, letters to individual physicians, newsletters, other informational materials such as posters and guidelines. The choice and development of interventions requires careful planning.

The primary causes of drug use problem need to be identified, together with key influencing factors.

STEP9:RE-EVALUATE TO DETERMINE IF DRUG USE HAS IMPROVED:

Drug use and prescribing patterns need to be monitored to determine the success of intervention. Typically, the re-evaluation is done 3 to 12 months after the introduction of the intervention, and should involve collecting the same data as in the original DUE evaluation.

STEP10: RE-ASSESS AND REVISE THE DUE PROGRAMME:

The questions addressed should include the following:

- Did the programme address important aspects of care?
- Were the criteria developed appropriate?
- Were the interventions made appropriate?
- Were drug use problem solved?

Hence, lessons learnt from the first DUE cycle should be used to improve quality , efficiency and effectiveness of future DUEs.

STEP11:FEEDBACK RESULTS:

It is important to circulate the results of the DUE to clinicians and other involved hospital staff. This is also a suitable time to obtain their opinions about the success or otherwise of the interventions, and how these can be improved. Some guidelines for the rational use of antibiotics are as follows:

- □ Prophylactic and empirical therapy of antibiotics should not be used unless and until in cases of emergency
- □ Culture sensitivity tests of antibiotics should be done in order to avoid resistance.
- □ Antibiotics are to be prescribed as per the spectrum of antibiotics
- □ The dosage of antibiotics should be as per the patient conditions. A gradual increase in the dose is to be done in case if efficacy is not seen.
- □ Parentral therapy is advocated unless until it is necessary.

According to the World Health Organization, drug utilization evaluation (DUE), sometimes referred to as drug utilization review (DUR), comprised of continuous, systematic, criteria-based drug assessment to ensure the appropriate use of drugs.It provides formal, structured and continuing review of prescribing pattern, pharmacist dispensing, and medication administration and use by patient. DUE may be performed in prospective, concurrent or retrospective

manner. Such studies not only ensure and influence appropriate medication decision making but also improve patient outcomes. DUE is a necessary element for periodic examination of drug misuse or unnecessary consumption of medical care and implementation of appropriate actions where required. Like other countries, irrational usage is a common problem attributed by unsafe treatment associated with increased adverse drug reactions and the rapid spread of antibiotic resistant in the community so must be concisely control. DUE measures the quality care and sustainability of drug therapy by determining drug usage data in health management. Such analyses are generally conducted to improve the clinical outcomes, prevent misuse of antibiotics, guideline compliance towards medical standards and to avoid drug-drug interactions. Rational utilization guide usually refers to selection of accurate medications, satisfactory dose, extent and effective management. Appropriate drug consumption helps health care practitioners in improving their routine treatment practice.

Antibiotics are widely prescribed by the health care professionals in emergency room and about 85 % of these prescriptions are generated by general practitioners.among different antimicrobials ,antibiotics are considered as most commonly used and misused among other drugs. Various studies have been conducted to explore provision of educational information to manage antibiotic usage. In acute hospitalization, about 20-30 % patients received antibiotics every day. European surveillance of antimicrobial consumption showed 18.53 % share of parenteral gentamicin. A study of hospitalized patients in Ethiopia accounted 25.6 % usage of gentamicin for pneumonia and acute gastroenteritis. Amikacin was first introduced as a broad spectrum aminoglycoside in 1981 to treat various infections caused by Gram-negative bacteria such as septicemia, meningitis, endocarditis, pneumonia and tuberculosis. Drug-induced hepatotoxicity is not usually reported and liver injury was found to be of very rare occurrence. Other common adverse effects included hypersensitivity reactions, nausea/vomiting, vertigo and headache[12]. Poor usage of amikacin may cause harmful effects; the results of a trial indicated only 48 % of patients treated with amikacin were exactly followed treatment guidelines. However according to a survey, most of the critically ill patients in intensive care unit (ICU) and burns unit of a hospital acknowledged 53.3 % of amikacin drug utilization. Ciprofloxacin, a fluoroquinolone was approved in 1987 to treat a variety of systemic infections. It is effective against lower respiratory tract infections, serious gastrointestinal (GI) infections, soft tissues and bone infections and typhoid. Ciprofloxacin found to be the treatment of first choice (42 %) for urinary tract infections (UTI) in 2005 as compared to (0 %) in 2007 by another trial. The clinical audit must be carried out to evaluate the accuracy of antibiotic consumption according to national guidelines.

In contrast, an appropriate DUE of ceftriaxone was higher (65.5 %) in Korean University hospitals for liver toxicity, GI complications and neuropathy. A few cases of ciprofloxacin-induced photosensitivity, hypersensitivity, anaphylaxis, vasculitis and erythema multiform were documented. Previous studies in Nepal and a Canadian province suggested fluoroquinolone as most widely prescribed group of antibacterials over a period of 3 y. A study documented appropriate use of ciprofloxacin against clinical indication among 95 % of patients. Similarly the trend of intravenous ciprofloxacin was higher (67.6 %) in Saudi Arabia.

In many instances, therapy was initiated with parenteral ciprofloxacin but later switched over to oral fluoroquinolones, one such study declared 26 % of parenteral administration of fluoroquinolones. In an American study, fluoroquinolones were most commonly used by multiple specialities in hospital internal medicine and urology.

Another research study reported the highest utilization of ciprofloxacin in UTI, acute gastroenteritis and chronic obstructive pulmonary disease. A decline in unjustified usage of ciprofloxacin has been reported from 31 to 13 % and its regular consumption found (28.4 %) for UTI by a survey research. In comparison to least use of gentamicin, approximately 1/3 of antibiotic utilization consists of ciprofloxacin. Further study revealed that only 26 % of patients who received ciprofloxacin were consistent with the indications given in hospital formulary.

The nitroimidazole antibiotic metronidazole has a limited spectrum of activity that encompasses various protozoans and most Gram-negative and Gram-positive anaerobic bacteria. Metronidazole has activity against protozoans like Entamoeba histolytica, Giardia lamblia and Trichomonas vaginalis, for which the drug was first

approved as an effective treatment. Anaerobic bacteria which are typically sensitive are primarily Gram-negative anaerobes belonging to the Bacteroides and Fusobacterium spp. Gram-positive anaerobes such as peptostreptococci and Clostridia spp. are likely to test sensitive to metronidazole, but resistant isolates are probably encountered with greater frequency than with the Gram-negative anaerobes.

METHODOLOGY

1.STUDY SITE AND STUDY DESIGN: Inpatient department of General medicine, Government General Hospital, Kakinada. It is a cross –sectional observational study.

2. STUDY DURATION: 5 Months (sample collection was done for a period of 3 months)

3. PARTICIPANTS :

Inclusion criteria:

- Patients prescribed with selected antibiotics like intravenous ciprofloxacin, ceftriaxone, metronidazole .
- Patients with various diseases admitted in general medicine department
- Those who are willing to participate in study.

Exclusion criteria:

- Patients who are critically ill.
- Patients with incomplete medications and records
- Not willing to give consent.

4. SAMPLING TECHNIQUE: purposive convenience

5. SAMPLE SIZE: 100

6. ETHICAL COMMITTEE APPROVAL:

Approval for the study was obtained from the general medicine department, Government General Hospital, Kakinada.

7.DATA COLLECTION:

- Patients reporting to the General medicine IP department of GGH Kakinada were seen by a qualified physician who diagnosed them based on chief complaints and laboratory findings such patients who were diagnosed with diseases such as GI diseases , CVA , renal and infectious diseases and have been on antibiotic were explained about the study.

  Those who agreed and gave a written informed consent were then applied the inclusion and exclusion criteria and were enrolled into the study .
- Past medical and medication history is gathered from the patient and incase patient is in unconscious state, information is taken from the patient representative.
- Socio demographic data like patient's IP no, unit ,ward, age, gender, occupation ,area of residence ,diagnosis ,social history ,marital status ,and antibiotics prescribed will be noted down from case sheet of patient onto a data collection form.
- A special designed data entry format was used to enter date of admission , final diagnosis, initiation and duration of antibiotic therapy , dose, dosing interval and frequency of administration of antibiotics , ceased date and reason for cessation .
- Laboratory test like serum creatinine, blood urea ,total blood count(haemoglobin , TLC,ESR, platelet count are taken .

8. DATA ANALYSIS:

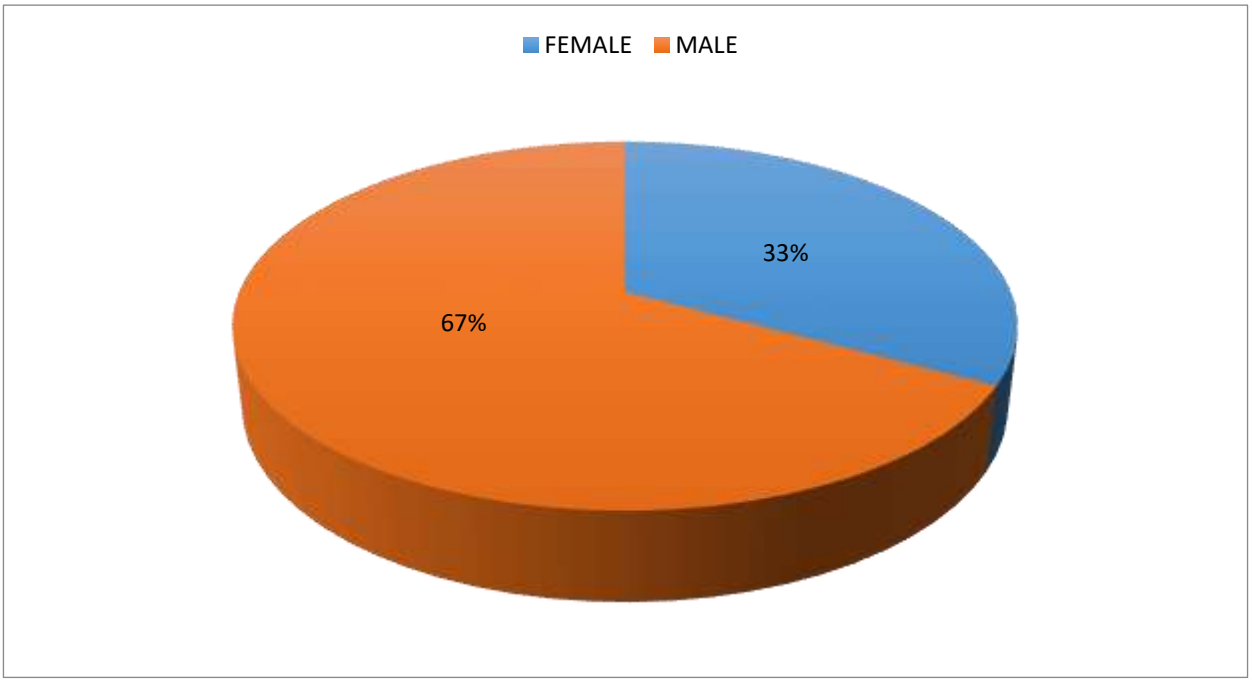
- Qualitative data like gender , employment status , marital status , social history ,number of antibiotics prescribed ,clinical outcome etc were represented as bar chart or pie chart. For qualitative data , chi-square test was applied . Frequency and percentage were calculated.
- Quantitative data such as age was represented as histogram.

RESULTS

TABLE NO:1 GENDER CATEGORISATION

S.No	Sex	No. of cases(n=100)	Percentage(%)
1.	Male	67	67%
2.	Female	33	33%

FIGURE NO.1: GENDER WISECATEGORISATION

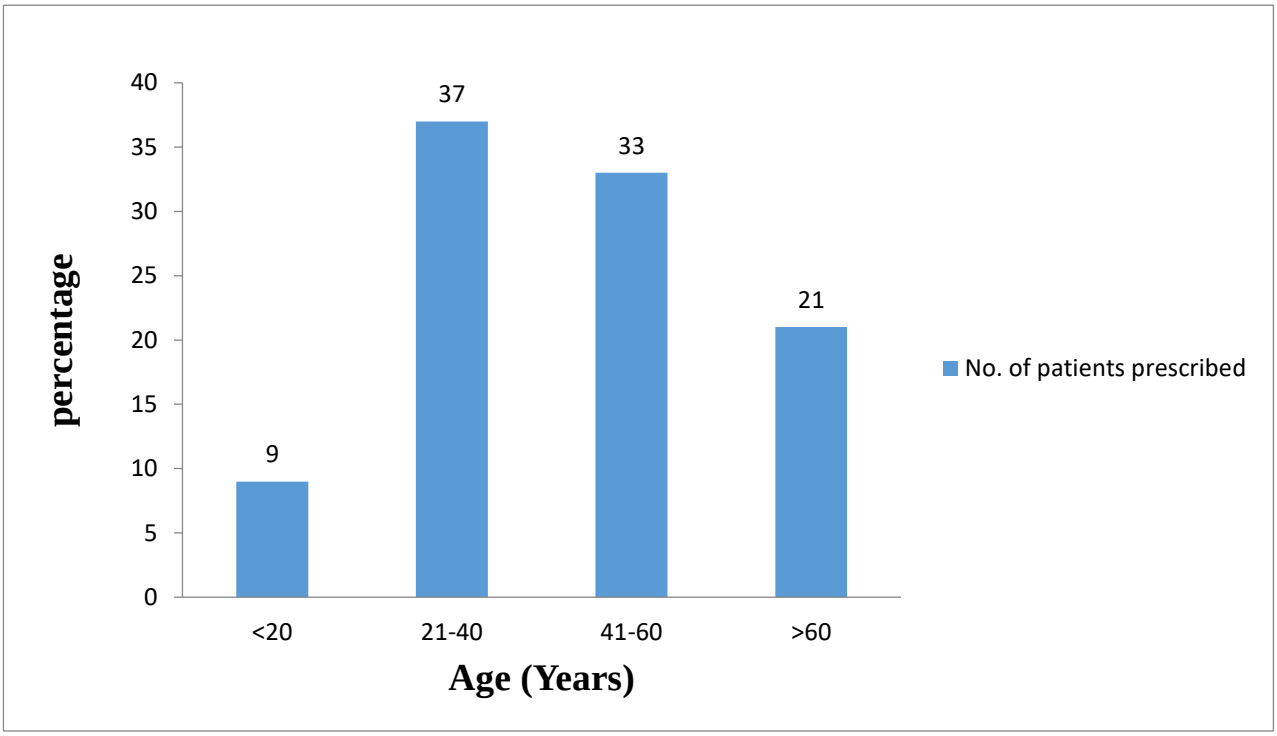


The study results shows that 67% of the patients were male and 33% were females.

TABLE NO:2 AGE WISE DISTRIBUTION

S.No	Age	No. of patients prescribed(n=100)	Percentage(%)
1.	<20	9	9%
2.	21-40	37	37%
3.	41-60	33	33%
4.	>60	21	21%

FIGURE NO.2: AGE WISE DISTRIBUTION

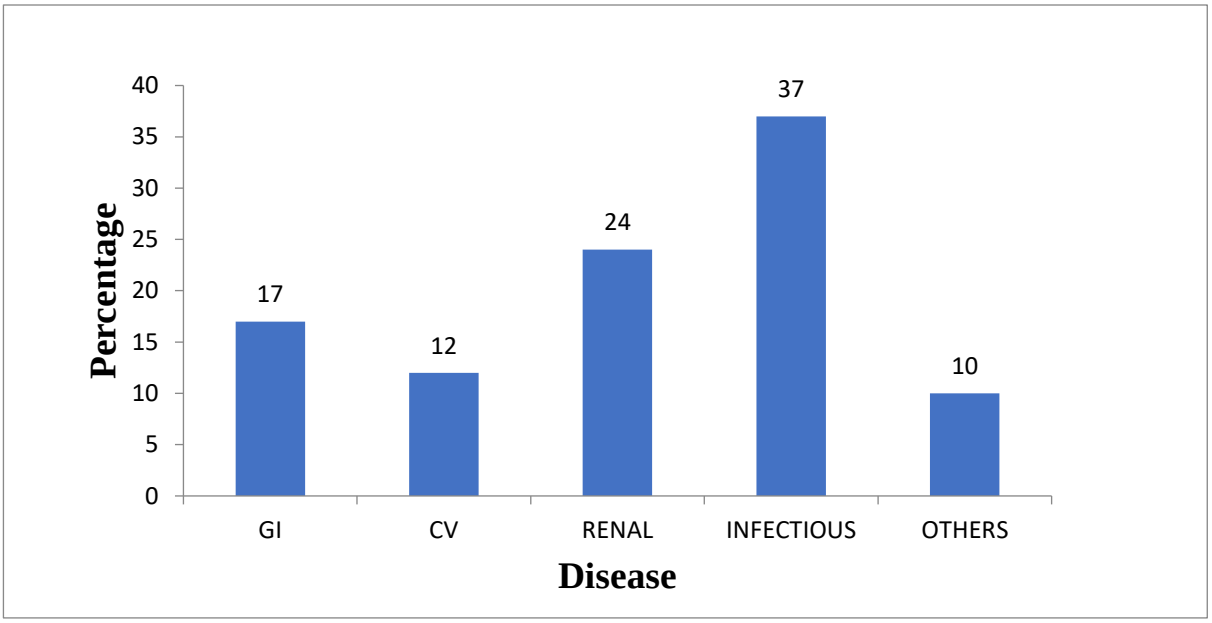


Age wise distribution of the patients were analysed and it was found that 9% of the prescriptions were in the age group of <20 years, followed by 37% in the age group of 21-40 years, 33% in the age group of 41-60 years, 21% in the age group of >60 years.

TABLE NO:3 ANTIBIOTICS PRESCRIBED BASED ON DISEASE

S.No	Disease	No. of patients(n=100)	Percentage(%)
1.	GI	17	17%
2.	CV	12	12%
3.	Renal	24	24%
4.	Infectious	37	37%
5.	Others	10	10%

FIGURE NO.3: ANTIBIOTICS PRESCRIBED BASED ON DISEASE

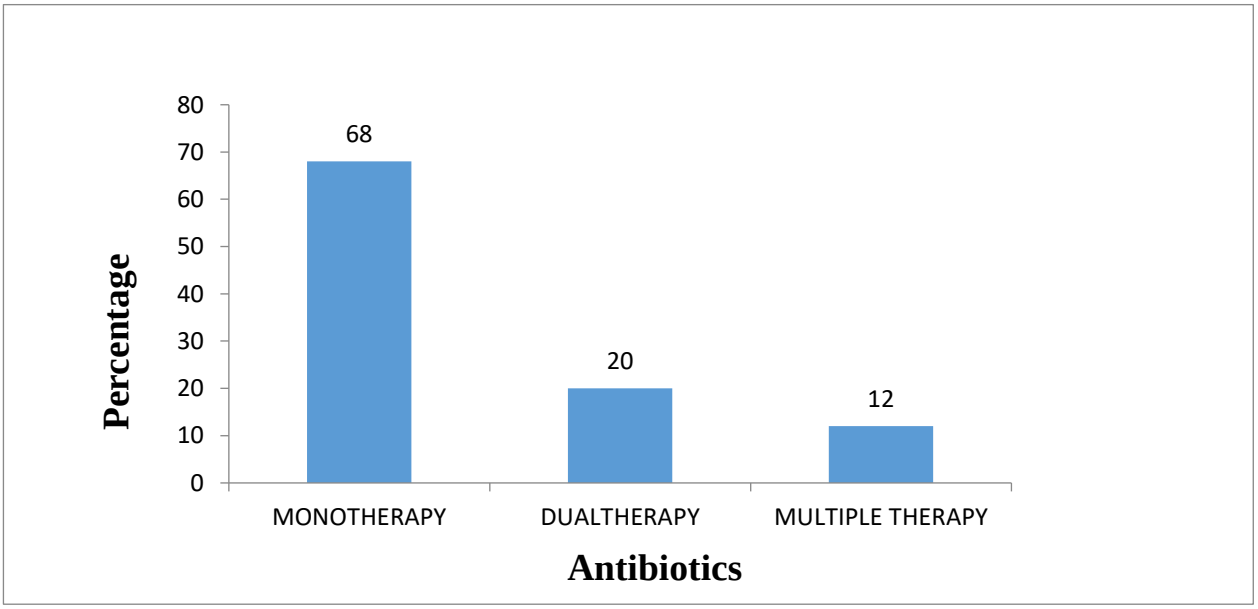


In the study on analysing antibiotics based on disease it was noted that 17% were affected with GI disease, followed by 12% with CV disease, 23% with Renal disorders, 37% with infectious disease and 11% with other diseases.

TABLE NO:4 NUMBER OF ANTIBIOTICS PRESCRIBED

S.No	Antibiotics	No. of prescriptions(n=100)	Percentage (%)
1.	Monotherapy	68	68%
2.	Dual Therapy	20	20%
3.	Multiple therapy	12	12%

FIGURE NO.4: NUMBER OF ANTIBIOTICS PRESCRIBED

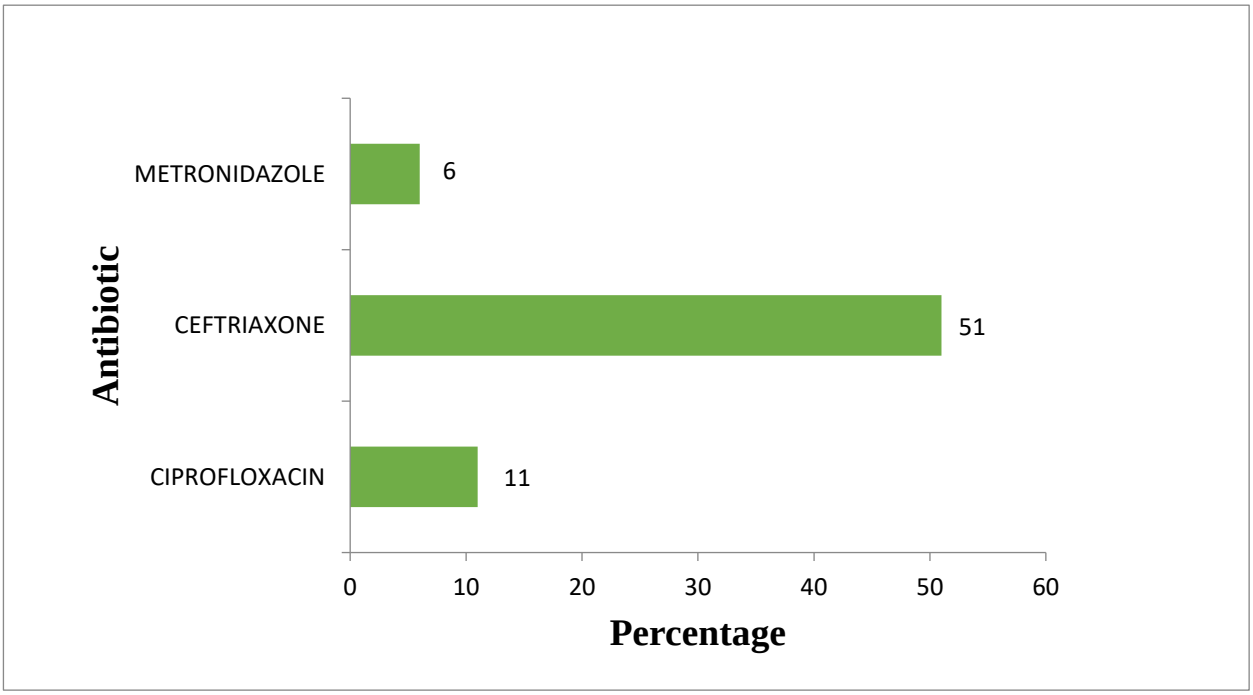


The study reports that the majority of the prescriptions were with Monotherapy constituting 68%, followed by 20% with Dual therapy and 12% with Multiple therapy.

TABLE 5: COMMONLY PRESCRIBED ANTIBIOTICS IN MONOTHERAPY

S.No	Antibiotic	No. of prescriptions(n=68)	Percentage(%)
1.	Ciprofloxacin	11	16.2%
2.	Ceftriaxone	51	75%
3.	Metronidazole	6	8.8%

FIGURE NO.5: COMMONLY PRESCRIBED ANTIBIOTICS IN MONOTHERAPY



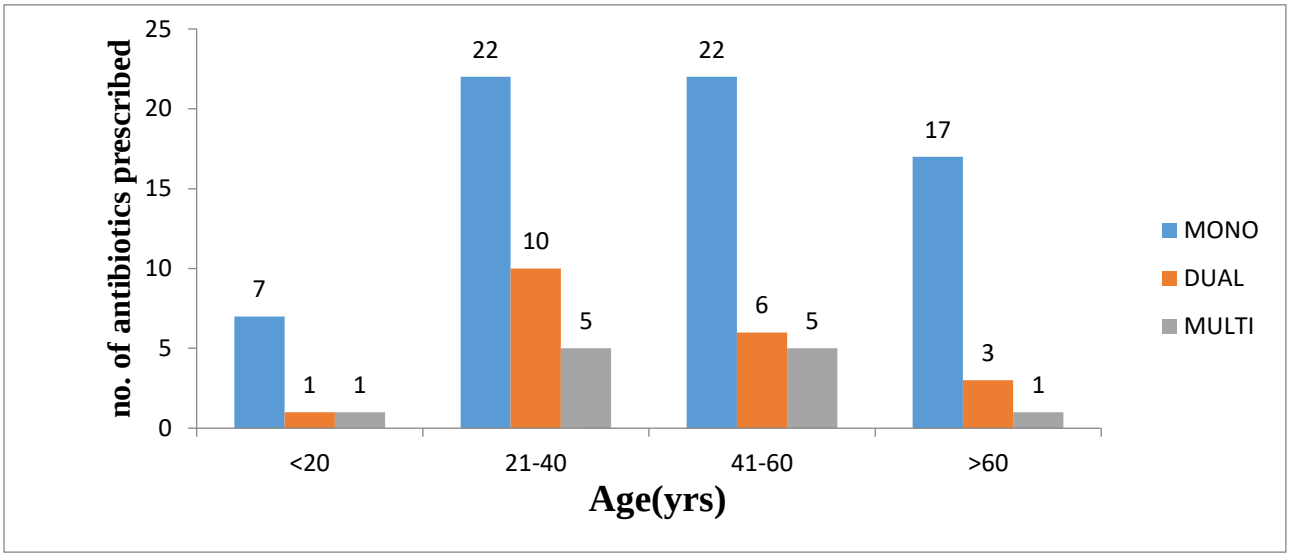
The study reports that in total of 100 prescriptions, 68 are of monotherapy. Of these, Ceftriaxone constitute 51(75%) prescriptions, followed by Ciprofloxacin with 11(16.2%) prescriptions and metronidazole with 6(8.8%) prescriptions.

TABLE NO:6 NUMBER OF ANTIBIOTICS PRESCRIBED BASED ON AGE

S.No	Age	Mono(n=68)	Dual(n=20)	Multiple(n=12)
1.	<20	7(10.2%)	1(5%)	1(8.3%)
2.	21-40	22(32.4%)	10(50%)	5(41.7%)
3.	41-60	22(32.4%)	6(30%)	5(41.7%)

4.	>60	17(25.0%)	3(15%)	1(8.3%)

FIGURE NO.6: NUMBER OFANTIBIOTICS PRESCRIBED BASED ON AGE

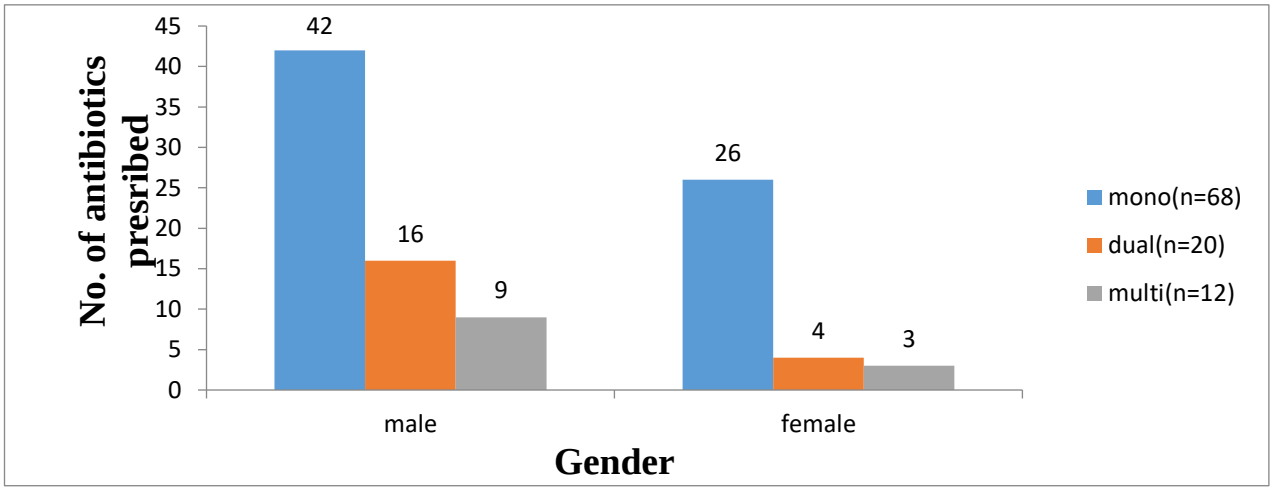


Number of antibiotic prescriptions based on age were analysed and found that most of the prescriptions were in the age group of 21-40 [mono-22(32.4%), dual -10(50%), multi-5(41.7%)], followed by 41-60 [mono-22(32.4%), dual-6(30%), multi-5(41.7%)]

TABLE NO:7 NUMBER OF ANTIBIOTICS PRESCRIBED BASED ON GENDER

S.no	Gender	Mono	Dual	Multi
1.	Male	42(61.7%)	16(80%)	9(75%)
2.	Female	26(38.3%)	4(20%)	3(25%)

FIGURE NO.7: NUMBER OF ANTIBIOTICS PRESCRIBED BASED ON GENDER

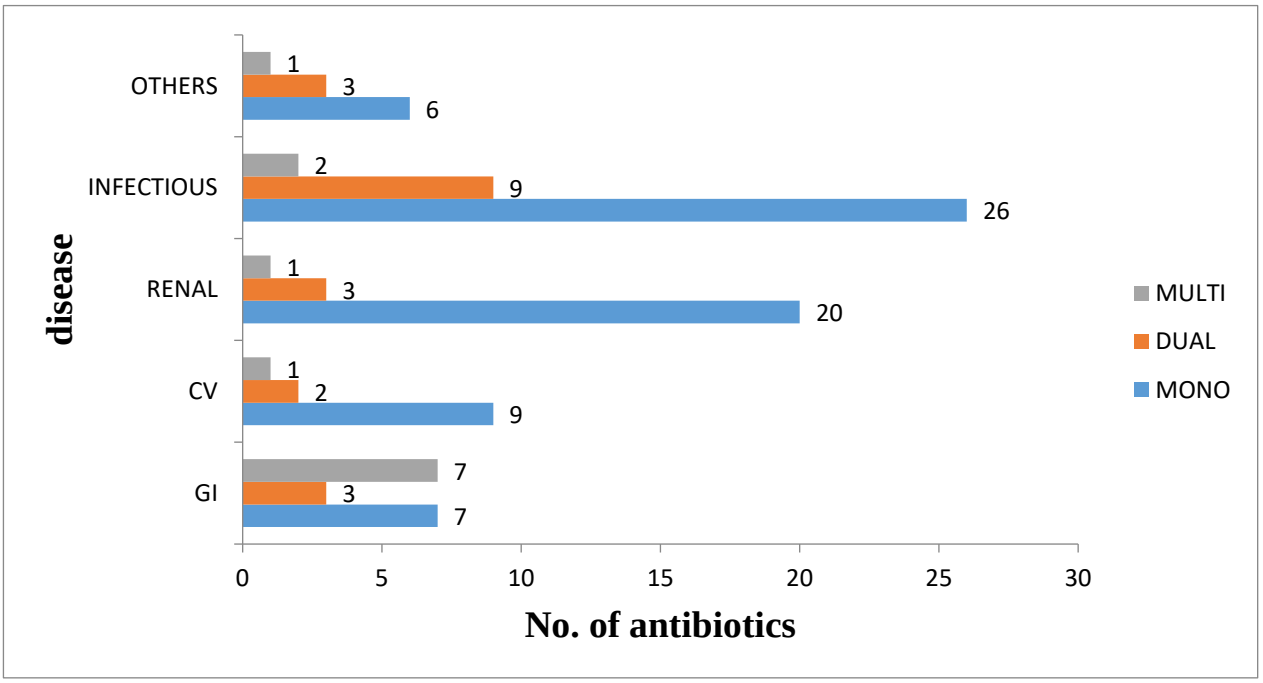


The number of antibiotics prescribed based on gender were analysed and it was found that males constitute of 67 precriptions [mono- 42(62.7%), dual- 16(23.9%), multi-9(13.4%)] followed by females of 33 prescriptions [mono-26(78.8%), dual-4(12.1%), multi-3(9.1%)].

TABLE NO:8 NUMBER OF ANTIBIOTICS PRESCRIBED BASED ON DISEASE

S.No	Disease	Mono	Dual	Multi
1.	GI(n=17)	7(41.8%)	3(17.64%)	7(41.18)
2.	CV(n=12)	9(75%)	2(16.7%)	1(8.3%)
3.	Renal(n=24)	20(83.33%)	3(12.5%)	1(4.17%)
4.	Infectious(n=37)	26(70.3%)	9(24.3%)	2(5.4%)
5.	Others(n=10)	6(60%)	3(30%)	1(10%)

FIGURE NO.8: NUMBER OF ANTIBIOTICS PRESCRIBED BASED ON DISEASE

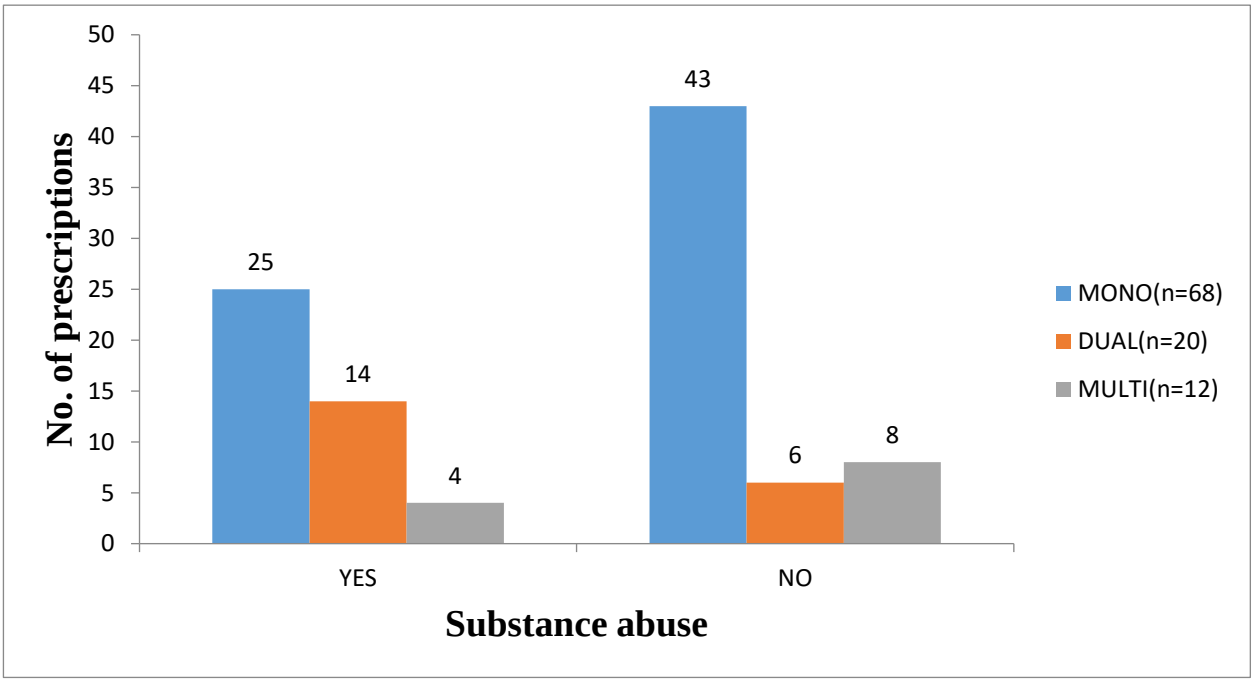


In current study, on analyzing number of antibiotics prescribed based on disease it was found that monotherapy was high in all the disease conditions.

TABLE NO:9 NUMBER OF ANTIBIOTICS PRESCRIBED BASED ON SUBSTANCE ABUSE

S.No	Substance abuse	Mono(n=68)	Dual(n=20)	Multi(n=12)
1.	Yes	25(36.8%)	14(75%)	4(33.3%)
2.	No	43(63.2%)	6(25%)	8(66.7%)

FIGURE NO.9: NUMBER OF ANTIBIOTICS PRESCRIBED BASED ON SUBSTANCE ABUSE



p-value*(<0.05) is considered as significant association (chi sq-7.48; p- value-0.02)

The number of antibiotics prescribed based on substance abuse were analysed statistically and found that there is significant association.

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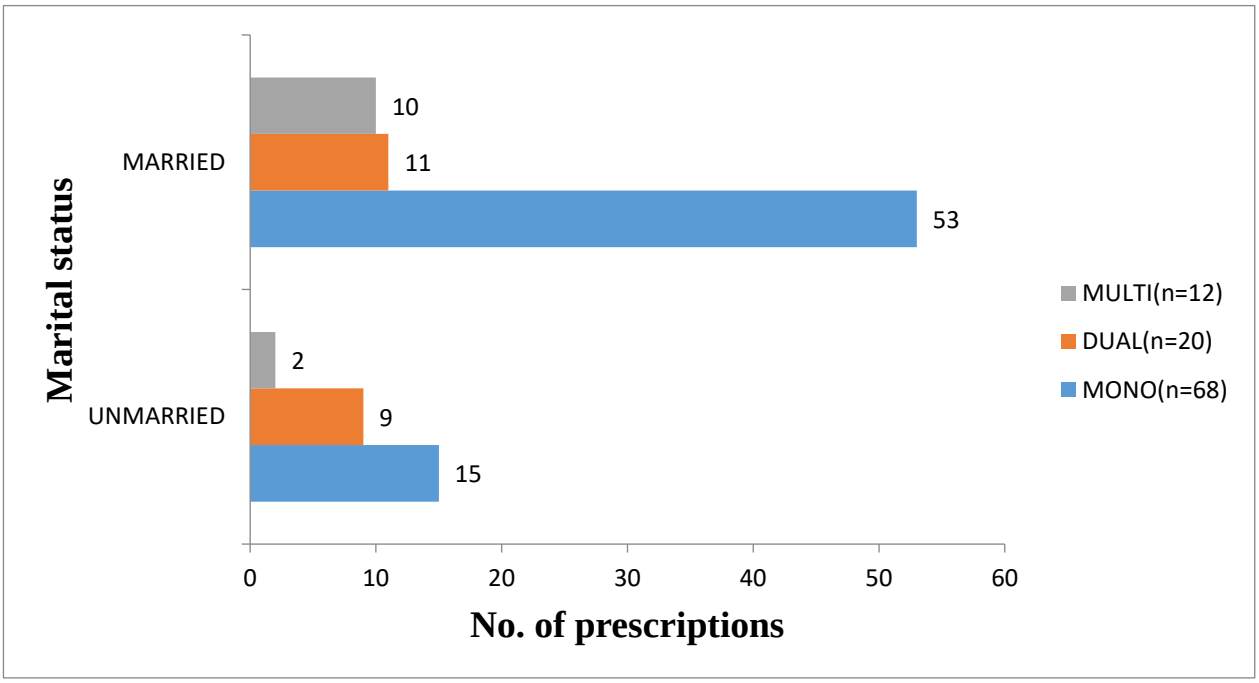
TABLE NO:10 NUMBER OF ANTIBIOTICS PRESCRIBED BASED ON MARITAL STATUS

S.No	Marital status	Mono(n=68)	Dual(n=20)	Multi(n=12)
1.	Unmarried	15(22.1%)	9(45.1%)	2(16.7%)
2.	Married	53(77.9%)	11(55.1%)	10(83.3%)

FIGURE NO.10: NUMBER OF ANTIBIOTICS PRESCRIBED BASED ON MARITAL STATUS

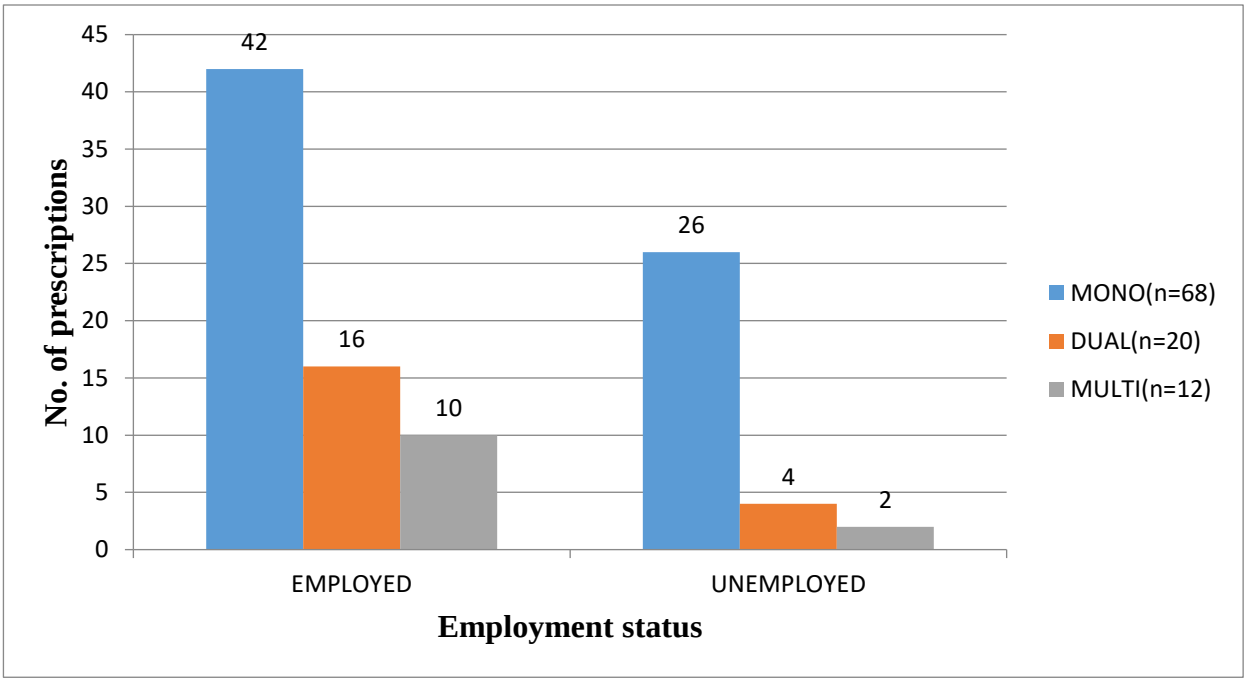


Number of antibiotics prescribed based on marital status were analysed statistically and it was found that there is no significant association.

TABLE NO:11 NUMBER OF ANTIBIOTICS PRESCRIBED BASED ON EMPLOYMENT STATUS

S.No	Employment status	Mono(n=68)	Dual(n=20)	Multi(n=12)
1.	Employed	42(61.8%)	16(80%)	10(83.3%)
2.	Unemployed	26(38.2%)	4(20%)	2(16.7%)

FIGURE NO.11: NUMBER OF ANTIBIOTICS PRESCRIBED BASED ON EMPLOYMENT STATUS

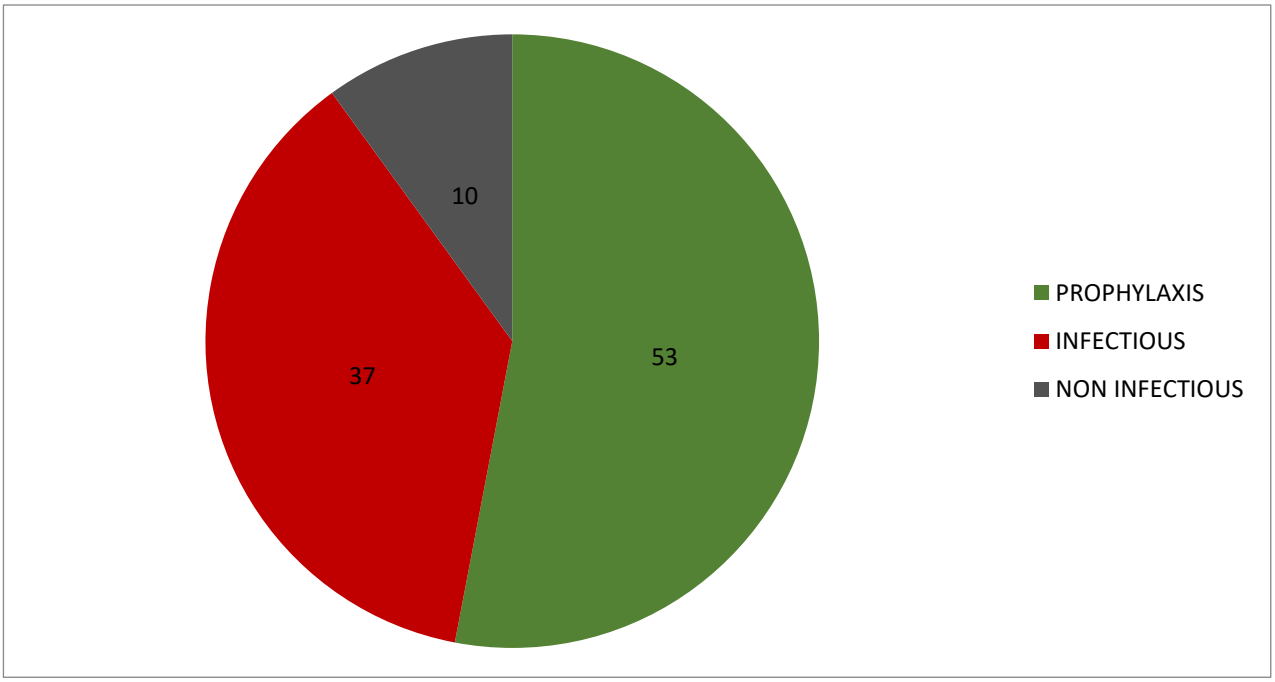


Number of antibiotics prescribed based on employment status were analysed statistically and it was found that there is no significant association.

TABLE NO:12 REASON FOR ANTIBIOTIC PRESCRIPTION

S.No	Reason for antibiotic prescription	No. of prescriptions	Percentage
1.	Prophylaxis	53	53%
2.	Infectious	37	37%
3.	Non-Infectious	10	10%

FIGURE NO.12: REASON FOR ANTIBIOTIC PRESCRIPTION

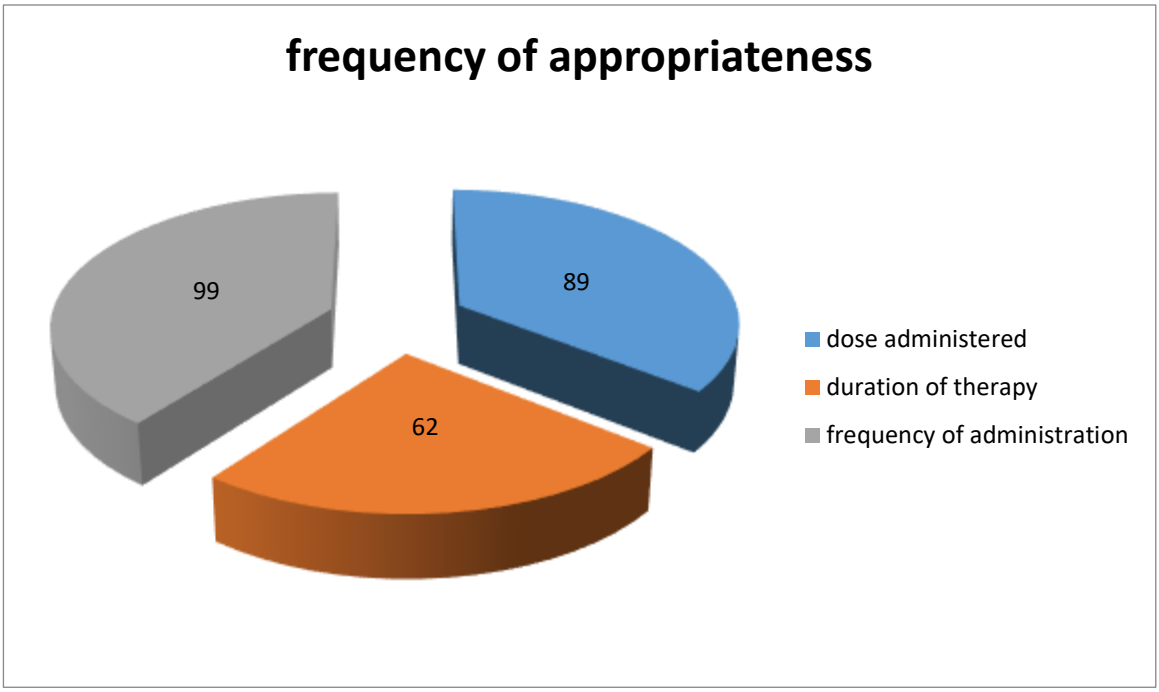


The study shows that 53% of the patients were prescribed with antibiotics for prophylaxis followed by 37% with proven infectious disease and 10% with non- proven infectious disease.

TABLE NO:13 ESTIMATION OF APPROPRIATENESS OF ANTIBIOTICS

S.No	Rationale of appropriateness	Frequency of appropriateness	Percentage
1.	Dose administered	89	89%
2.	Duration of therapy	62	62%
3.	Frequency of administration	99	99%

FIGURE NO.13: ESTIMATION OF APPROPRIATENESS OF ANTIBIOTICS



Appropriateness of antibiotics was estimated.

TABLE NO.14 ESTIMATION OF APPROPRIATENESS OF CEFTRIAXONE, CIPROFLOXACIN, METRONIDAZOLE AS MONOTHERAPY

S.No	Rationale of appropriateness	Ceftriaxone(n=51)	Ciprofloxacin (n=11)	Metronidazole (n=6)
1.	Dose administered	43(84.3%)	11(100%)	6(100%)
2.	Duration of therapy	41(80.3%)	0(0%)	2(33.3%)
3.	Frequency of administration	50(98.03%)	11(100%)	6(100%)

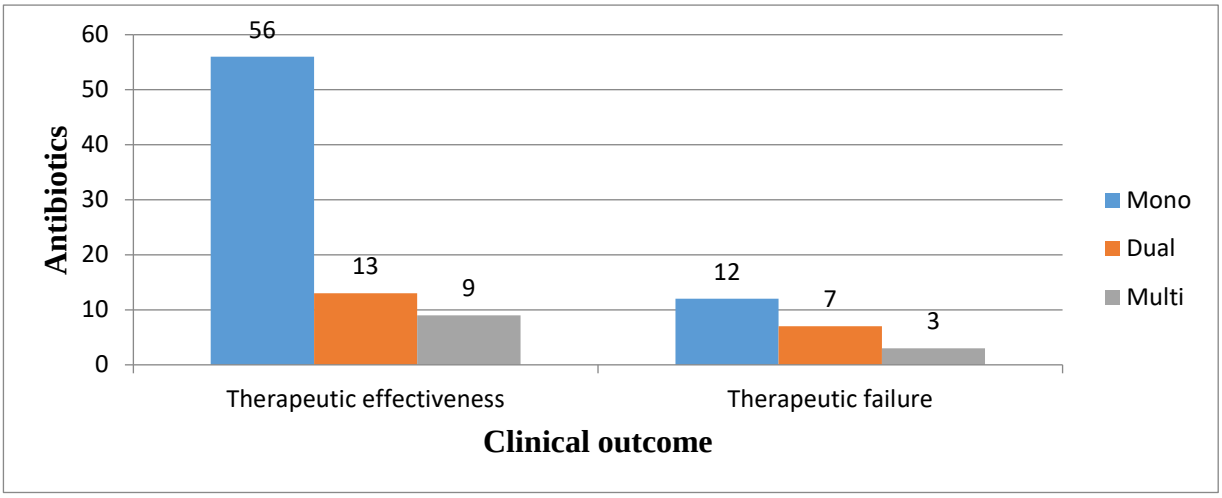
Estimation of appropriateness of ceftriaxone, ciprofloxacin, metronidazole as monotherapy was analysed and it was found that there was appropriateness in dose administered and frequency of administration. There was inappropriateness in duration of therapy in case of ciprofloxacin.

TABLE NO:15 AVERAGE CLINICAL OUTCOME OF ANTIBIOTICS

S.No	Clinical outcome	Mono(n=68)	Dual(n=20)	Multi(n=12)
1.	Therapeutic effectiveness	56(82.35%)	13(65%)	9(75%)

2.	Therapeutic failure	12(17.7%)	7(35%)	3(25%)

FIGURE NO.15: AVERAGE CLINICAL OUTCOME OF ANTIBIOTICS



In our study clinical outcome of antibiotics was analysed and it was found that the therapeutic effectiveness was high in case of monotherapy(82.3%) followed by multi(75%) and dual(65%) therapy.

TABLE NO.16 FACTORS EFFECTING THE NUMBER OF ANTIBIOTICS PRESCRIBED

DOMAIN		**NUMBER OF ANTIBIOTICS PRESCRIBED**			**X^2 VALUE**	**P-VALUE**
		Mono	Dual	Multi		
Age	<20 Yrs	7(10.2%)	1(5%)	1(8.3%)	3.98	0.679
	21-40 Yrs	22(32.4%)	10(50%)	5(41.7%)		
	41-60 Yrs	22(32.4%)	6(30%)	5(41.7%)		
	>60 Yrs	17(25%)	3(15%)	1(8.3%)		
Gender	Male	42(61.8%)	16(80%)	9(75%)	2.72	0.256
	Female	26(38.2%)	4(20%)	3(25%)		
E.S	Employed	42(61.8%)	16(80%)	10(83.3%)	3.19	0.20
	Unemployed	26(38.2%)	4(20%)	2(16.7%)		
SB ABUSE	Yes	25(36.8%)	14(70%)	4(33.3%)	7.48	**0.02***
	No	43(63.2%)	6(30%)	8(66.7%)		
MA	Married	53(77.9%)	11(55%)	10(83.3%)	4.84	0.08
	Unmarried	15(22.1%)	9(45%)	2(16.7%)		
Disease	GI	7(10.3%)	3(15%)	7(58.5%)		
	CV	9(13.2%)	2(10%)	1(8.3%)		
	Renal	20(29.4%)	3(15%)	1(8.3%)	19.27	**0.013***
	Infectious	26(38.3%)	9(45%)	2(16.6%)		
	Others	6(8.8%)	3(15%)	1(8.3%)		

p-value*(<0.05) is considered as significant association.
Table: 15 showed the factors affecting the number of antibiotics prescribed and the results were as follows:

1.Age and number of antibiotics prescribed :
In the <20 yrs age group , 10.2% were prescribed with monotherapy and 32.4% of each age group 21-40 , 41-60 were prescribed with monotherapy .Hence, majority of monotherapy was prescribed in age group 21-60 yrs. In case of dual therapy, majority of antibiotics are given in age group of 21-40 yrs (50%). In multi therapy majority of antibiotics were given in age group 21-60 yrs. Results of current study shows that there is no significant relationship between age and antibiotics prescribed.(p -value =0.679)

2. Gender and number of antibiotic prescribed :
Prescription of antibiotics was higher in males than in females in case of monotherapy ,dual therapy and also in multiple therapy. Therefore, there is no significant relationship between gender and antibiotics prescribed(p –value =0.256)

3. Employment and number of antibiotic prescribed :
Majority of patients were employed in case of monotherapy (61.8%), dual therapy(80%), multitherapy(83.3%). There is no significant relationship between employment and number of antibiotics prescribed (p-value=0.20)

4. Substance abuse and number of antibiotics prescribed:
Majority of patients prescribed with monotherapy are without substance abuse(63.2%), majority of patients prescribed with dual therapy are with substance abuse (70%),in case of multitherapy majority of them are without substance abuse (66.7%). There is a significant relationship between number of antibiotics prescribed with substance abuse (p –value=**0.02*)**

5. Marital status and number of antibiotics prescribed :
Majority of patients were married in case of monotherapy (77.9%),dual therapy(55%) and multi therapy (83.3%). There is no significant relationship between number of antibiotics and marital status. (p –value=0.08)

6. Diseases and number of antibiotics prescribed:
In case of monotherapy, the number of prescriptions were higher with infectious disease(38.3%) followed by renal disease (29.4%). In dual therapy, the number of prescriptions were higher with infectious disease (45%) followed by GI(15%),renal (15%).In multitherapy ,the number of prescriptions were higher with GI disease (58.5%) followed by infectious disease(16.6%). There is significant association between diseases and number of antibiotics prescribed (p-value=**0.013*)**

TABLE NO.17 DURATION OF STAY OF PATIENTS RECEIVING CEFTRIAXONE, CIPROFLOXACIN AND METRONIDAZOLE AS MONOTHERAPY

S.No	Duration (days)	Ceftriaxone (n=51)	Ciprofloxacin (n=11)	Metronidazole (n=6)
1.	<5	24(47%)	9(81.8%)	2(33.3%)
2.	5	10(19.6%)	2(18.2%)	0
3.	>5	17(33.4%)	0	4(66.7%)

p-value*(<0.05) is considered as significant association chi sq-9.7 p-value- 0.04*

In our study, duration of stay of patients receiving ceftriaxone, ciprofloxacin and metronidazole as monotherapy was analysed statistically and it was found that there is significant association between duration of stay and antibiotic received**(p=0.04)**

DISCUSSION

The current study was conducted on 100 patients who are receiving antibiotics like ceftriaxone, ciprofloxacin, metronidazole. The current study on gender categorization revealed that overall population was predominantly male population. In a similar study conducted by **Ravi pathiyal Shankar et al(2003)** also noted that majority of population was male population .

Age wise distribution was analysed and found that most of the prescription were in the age group of 21-40 years and 41 -60 years .Similar study conducted by Mujtaba Hussain et al (2014) also found that most of prescription were in the age group of 40-60 years.

In the present study , categorization based on disease was analysed and found that most of the patients were having infectious diseases which was similar to a study conducted by Mohanraj Rathivelu et al (2015) who reported that majority of patients had urinary tract infections.

In the current study , the majority of antibiotic used in monotherapy was ceftriaxone .The antibiotics prescribed in the monotherapy was ceftriaxone with 51(75%), followed by ciprofloxacin with 11(16.2%), then metronidazole (8.8%). Similar results were found in a study conducted by **Gauhati** shows that 60% patients had received single antibiotic. ceftriaxone was commonly prescribed antibiotic of 43.49% .

In present study states majority of antibiotics were given as single antibiotic and it was similar to a study conducted by **R Selvaraj et al (2015)** which has single antibiotic as majority antibiotic.

The current study reports that majority of the antibiotics were prescribed for prophylactically and followed by infectious diseases. This study was similar to **Suhena R patel et al** that on analyzing the type of antimicrobials use, it was found that majority of the patients (107; 94.69%) were prescribed the antimicrobials prophylactically. Only six patients showed confirmed diagnosis of infectious disease and were prescribed antimicrobials empirically at the time of admission in ICU. Ceftriaxone was most commonly (69; 61.60%) prescribed antimicrobial agent.

The current study reports that antibiotics prescribed are in terms of generic name. This study was similar to that of **Mohd.Mahmood et al** in which they identified prescribing in terms of generic name provides cost effective treatment.

The current study reports that there was a predominance of middle age group in the study sample and the maximum number of patients treated with monotherapy of antibiotic . This study was similar to study conducted by **Nathiya –D et al** and also found there were more middle age prescription and were treated with single antibiotic.

The cuurent study reports that there is empiric use of the drug ceftriaxone for cases other than it's primary indication. This study was similar to **Alemayechu et al** thus the adherence to current evidence based guidelines is recommended. The hospital should also realize continous and ongoing drug use evaluation.

The present study states that out of 36 patients who are conformed with infectious disease for prescribed antibiotics empirically at the time of admission and it was changed to definitive antimicrobial therapy based on culture and sensitivity report in one patient only .This is similar to a study conducted by **Suhena R patel et al** which shows that only six patients showed confirmed diagnosis of infectious disease and were prescribed antimicrobials empirically at the time of admission in ICU, and it was changed to definitive antimicrobial therapy based on culture and sensitivity report in three patients only .

The current study reports that the average clinical outcome and the appropriateness of monotherapy, Dual therapy and multi therapy were calculated as therapeutic effectiveness and therapeutic failure were estimated. This is similar to a study conducted by **H Ali et al (2018)** which also estimated the appropriateness and average clinical outcome of ciprofloxacin, amikacin, meropenem.

In our study out of 68 prescriptions of monotherapy , it was found that drug utilization rate of ceftriaxone was high with a mean duration of 5.27 days with a range of 2-16 days. More than 2/3rd (87.5%) use of ceftriaxone was found

to be appropriate and it is justified by use of ceftriaxone emanated from dose administered (84.3%), duration of therapy(80.39%)and frequency of administration (98%). Study reports of **Asnakew Achaw Ayele et al** showed that there is inappropriateness of ceftriaxone due to inappropriate duration of therapy and frequency of administration.

In the current study there is no significant association between mono , dual and multi with socio-demographic characteristic like age, gender, employment status and marital status. There is a significant association between the disease and the number of antibiotics prescribed and also substance abuse and the number of antibiotics prescribed.

CONCLUSION

- Majority of subjects were given with monotherapy(68%) in our study and results showed that in monotherapy ,ceftriaxone was given at a higher rate(75%) followed by ciprofloxacin (16.2%) and metronidazole (8.8%)
- Significant proportion of the subjects aged 21-40 years were more in our study with respect to the number of antibiotics prescribed.
- Majority of the subjects belonged to the male gender (67%) compared to female gender(33%).
- However , no significant association was found between the number of antibiotics prescribed with socio-demographic characteristics like age ,gender, marital status, employment status .
- In the current study , by comparing the number of antibiotics prescribed with respect to the disease it was found that majority of antibiotics were prescribed for infectious diseases. Statistically , significant association was found between disease and number of antibiotics prescribed .
- Statistically, significant association was found between substance abuse and number of antibiotics prescribed.
- In the current study, in case of dose administered and frequency of administration , appropriateness of ceftriaxone, ciprofloxacin , metronidazole was found to be high whereas in case of duration of therapy there is inappropriateness use of ciprofloxacin and metronidazole.

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