

A Prospective Observational Study on Drug Utilization and Prescription Pattern of Antibiotics in an Orthopedic Hospital

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ABSTRACT

Background: Drug therapy is an important part of disease management in hospitalized patients, but when the appropriateness of the therapy is not up to the point it is associated with various negative consequences. Drug utilization research plays an important role in clinical practice to promote rational use of drugs. It forms the basis of making important decisions regarding prescribing of potent drugs in hospitals. Antibiotics are one of the most commonly prescribed drugs for prophylaxis and for the treatment of various infections in hospitalized patients. In recent years, there has been increasing attention given to the issue of antibiotic resistance. The wounds of orthopedic surgeries are often deep-seated and difficult to treat and therefore, the patients who undergo surgery are at high risk of developing hospital-acquired infections with a risk of long-term recurrence. Hence the use of an antibiotic is important in preventing infections related to surgical cuts and implants, and consequently to decrease the morbidity and mortality in orthopedic surgeries.

Materials and Methods: The study was conducted in a Tertiary care Hospital in Karimnagar specifically in the Orthopedic ward as the study involves patients who have undergone orthopedic surgical procedures. This study was conducted during the period from September 2021 to May 2022. It is a prospective and observational study where the sample selection is done by randomization, subject's medical records are analyzed to extract the information. The study includes randomly selected patients with confirmed microbial infection and patients undergoing orthopedic surgery, patients of all ages and gender. Diabetic patients, minor incisions and pregnancy cases were excluded from the study.

Results: Ceftriaxone was found to be the most commonly administered drug as a prophylactic agent. Cefotaxime was commonly given to patients in post operative conditions and among all the enrolled cases in the study, majority of patients were given Ceftriaxone with Metronidazole I.e., Cephalosporin antibiotics in combination with nitroimidazole antibiotics.

Conclusion: We conclude through our study that the cephalosporin class of drugs were the most commonly used drugs in orthopedic department because of their safety and efficacy, and all the antibiotics that were given are being used appropriately to ensure positive patient outcomes.

Keywords: Antibiotics, Drug Utilization Evaluation, Orthopaedics, Ceftriaxone, Cefotaxime, Metronidazole, Cephalosporins

I. INTRODUCTION

Drug therapy is an important part of disease management in hospitalized patients, but when the appropriateness of the therapy is not up to the point it is associated with various negative consequences. Various practices like Overuse of drugs, polypharmacy and the prescribing of inappropriate drugs are seen mostly in low and middle-income countries. Drug therapy accounts for up to 60% of total healthcare costs and hence it is important that the therapy needs to be appropriate ^[1]. Drug utilization research plays an important role in clinical practice to promote the rational use of drugs. It forms the basis of making important decisions regarding prescribing of potent drugs in hospitals. It also helps in developing strategies to utilize the available healthcare resources in the most efficient manner ^[2]. Periodic evaluation of utilization patterns of drugs helps in identifying the problems of irrational and inappropriate use of drugs ^[3]. Antibiotics are one of the most commonly prescribed drugs for prophylaxis or for the treatment of various infections in hospitalized patients ^[4]. In recent years, there has been increasing attention given to the issue of antibiotic resistance, as demonstrated in a report by the World Health Organization (WHO) on antimicrobial resistance and surveillance ^[5]. The WHO report called for concerted cross-sectional action by governments and society as a whole and described the issue as a

global health security threat ^[5]. As there are limited numbers of antibiotics available, resistance to first-line treatments has become increasingly common, resistance to antibiotics results in higher healthcare costs, as patients require more expensive and longer treatments and is associated with a greater risk of mortality from diseases that were previously curable ^[6]. The rational use of antibiotics not only relates to the actions of providers in ensuring patients receive appropriate treatment for their condition, at the right time in the right dose and for the right duration, but also those of patients, in adhering to the treatment regimens prescribed, completing the full course and not sharing with or storing the medicines for future use. In 2001, the WHO Global Strategy for Containment of antimicrobial resistance highlighted the need for the development and use of guidelines and treatment algorithms to promote the appropriate use of antimicrobials, and also the importance of supervision and support of clinical practices, especially diagnostic and treatment strategies. Additionally, it highlighted that healthcare providers have an important role to play in educating patients on the importance of medication adherence ^[7]. WHO estimates that more than half of all available medicines are prescribed, dispensed or sold inappropriately, and that half of all patients fail to adhere to their medication, overuse, underuse or misuse of medicines results in wastage of scarce resources and increased risk of widespread health hazards ^[8]. Some of examples of irrational use of medicines include: Prescribing too many medicines per patient (poly-pharmacy); inappropriate use of antimicrobials, often in inadequate dosage, or for non-bacterial infections; over-use of intravenous preparations when oral formulations would be more appropriate; failure to prescribe in accordance with clinical guidelines and protocols; inappropriate self-medication, often of prescription-only medicines; non-adherence to dosage regimen ^[8].

DRUG UTILIZATION EVALUATION: WHO in 1977 defined Drug Utilization Evaluation (DUE) or Medication Use Evaluation(MUE) as the prescription, distribution, marketing, and drugs used by a patient, with special emphasis on the resulting medical, social and economical consequences ^[9]. Medication-use evaluation (MUE) is a procedure that focuses on analyzing medication use with the goal of achieving ideal patient outcomes ^[10]. Drug Utilization Evaluation (DUE), is defined as an authorized, structured, ongoing review of a prescription written by the health care provider, dispensing of the prescription by the pharmacist, and medication use by the patient. Drug utilization evaluation involve a review of patient's prescription and medication data before, during, and after dispensing to ensure appropriate medication decision is being made and positive patient outcome is being obtained ^[11].

II. METHODOLOGY

Study site: The study was conducted in a Tertiary care Hospital in Karimnagar specifically in the Orthopedic ward as the study involves patients who have undergone orthopedic surgical procedures.

Study duration: This study was conducted during the period from September 2021 to May 2022.

Study design: It is a prospective and observational study where the sample selection is done by randomization, subject's medical records are analyzed to extract the information.

Inclusion criteria: The study includes randomly selected patients with confirmed microbial infection and patients undergoing orthopedic surgery, patients of all ages and gender.

Exclusion criteria: Diabetic patients, minor incisions and pregnancy cases were excluded from the study.

Sample size: the study was conducted on a total of 202 patients in orthopedic in-patient department.

The study is a prospective and observational study conducted on hospitalized patients from September 2021 in the Orthopedics ward at private multispeciality hospitals in Karimnagar, Telangana. The hospitalized patients are prescribed at least one antibiotic and aged 15 years and above were enrolled in the study. The patients not prescribed any medicine or attended the outpatient department or were admitted in the other departments were excluded. The data is collected using two types of semi-structured proforma; encounter form for collecting socio-demographic data like age, gender, marital status, medical history, diagnosis, drugs prescribed with their doses, frequency and route of administration, dosage form, and duration of drug therapy. The outcome variables were a therapeutic group and number of drugs prescribed per therapeutic group and number of antibiotics used, prescription frequency of individual antibiotics, prescription frequency of class of antibiotics, the average number of drugs and antibiotics prescribed per patient, classification of antibiotics, and antibiotics consumption.

III. RESULTS

It is a prospective study carried out in different tertiary care hospitals in Karimnagar for a period of 6 months. A total of 204 cases were collected in inpatient department. The following evaluations were made from the data collected.

Table 1: Socio-Demographic Characteristics Of Patients-Gender

S. no	Gender	No. of patients	Percentage
1.	male	135	66.83%
2.	female	67	33.16%
3.	total	202	100%

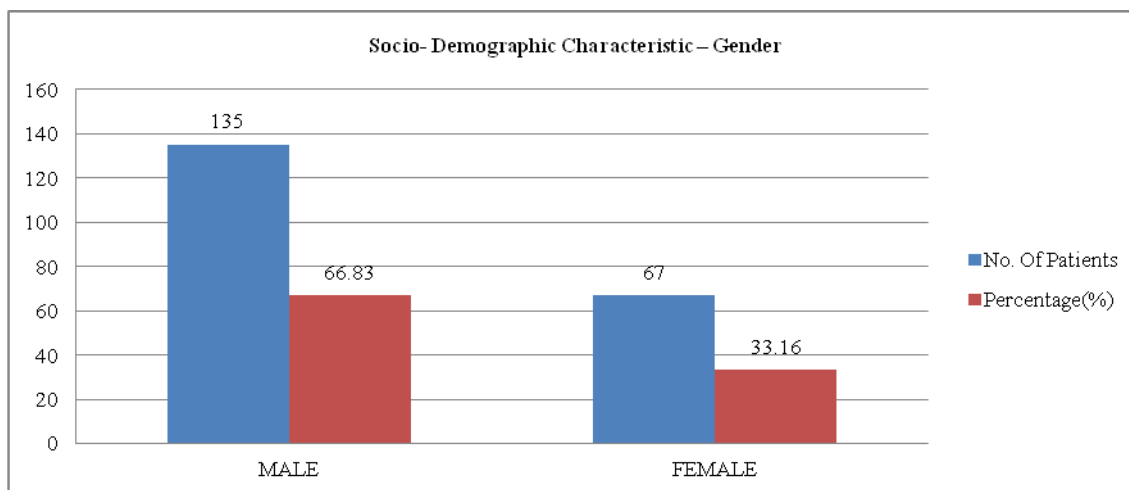


Figure 1: Socio-Demographic Characteristic – Gender

Figure 1 shows that among all the patients enrolled in the study, male patients were found to be more in number i.e, 137 when compared to female patients i.e, 67 and the percentages for the same were found to be male (66.83%) and female (33.16%).

Table 2: Socio-Demographic Characteristics Of Patients-Age

Age group	No. Of patients	Percentage
15-20	3	1.48%
20-30	33	16.33%
30-40	45	22.27%
40-50	35	17.32%
50-60	41	20.29%
60-70	25	12.37%
70-80	20	9.90%
TOTAL	202	100%

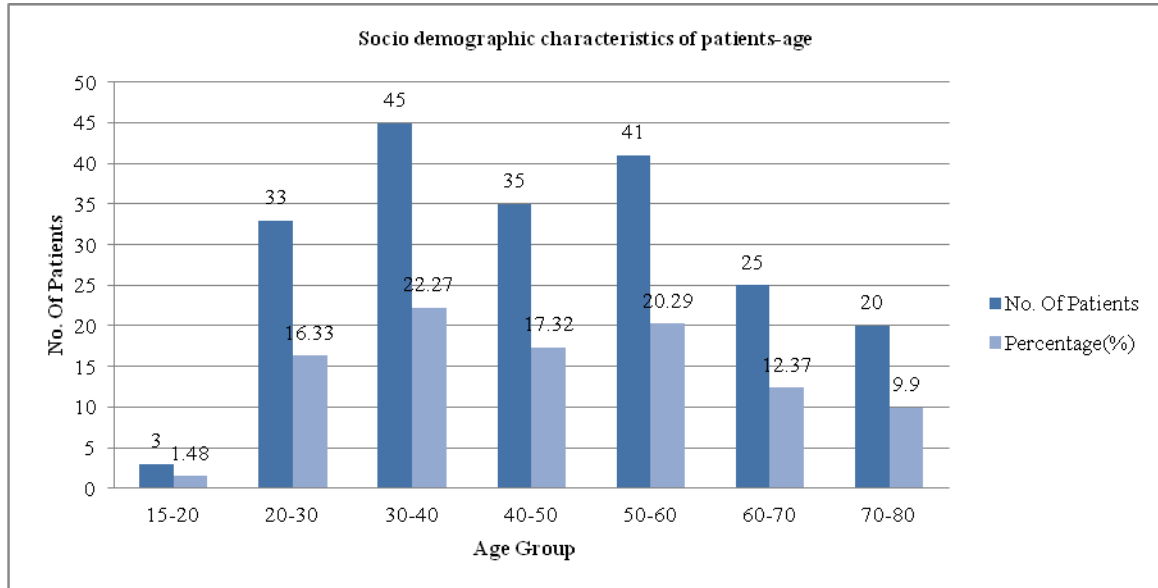


Figure 2: Socio-Demographic Characteristics Of Patients-Age

Figure 2 shows the graphical representation of different age groups of people that were admitted in the orthopedic in-patient department due to various medical conditions related to their bones and associated tissues. Among all the patients enrolled in the study the majority of patients were found to be in the age group of 30-40(45 patients) followed by 50-60 (41 patients), 40-50 (35 patients), 20-30 (33 patients), 60-70 (25 patients), 70-80 (20 patients) and the least number of patients were found to be in the age group of 15-20 (3 patients).

Table 3: Age Vs Gender Distribution Among The Collected Cases

Age group	Male	Female
15-20	3	0
20-30	27	6
30-40	36	9
40-50	27	8
50-60	17	24
60-70	13	12
70-80	12	8
TOTAL	135	67

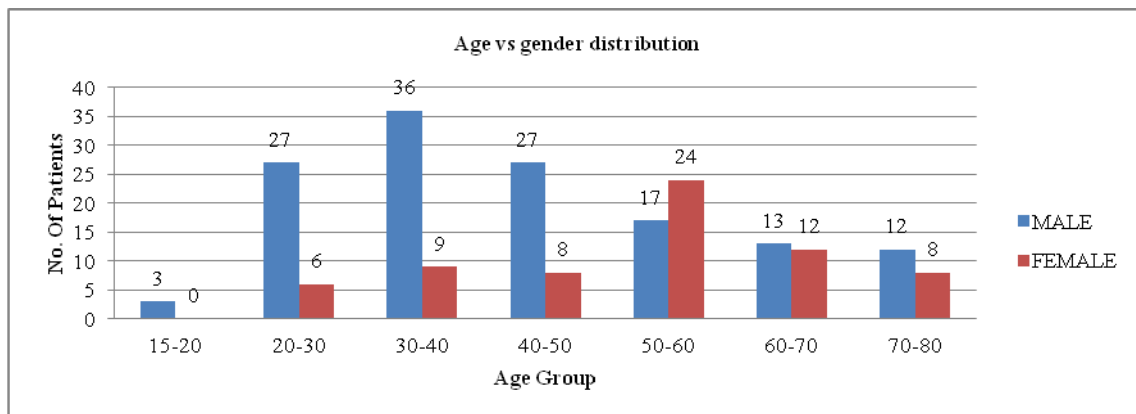


Figure 3: Age Vs Gender Distribution

Figure 3 shows the distribution of male and female patients in different age groups, while the majority of patients were males, in the age group of 50-60 females were found to be higher than males (in the ratio of 24:17) suggesting that more number of females have been admitted in the hospital and the main reason for admission being Osteoarthritis due to various household works carried out by women and age factors. In the remaining age groups, males were found to be higher in number and the reasons for admission to the hospital were Road Traffic Accidents (RTA) and injuries at the workplace.

Table 4: Distribution Showing Educational Status Of Patients

Educational status	No. Of patients	Percentage
Literate	158	78.21%
Illiterate	44	21.78%

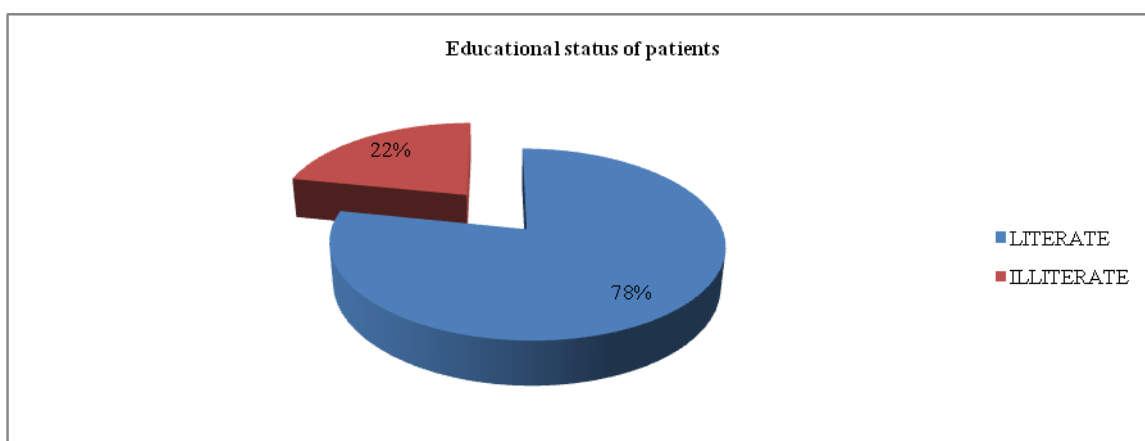


Figure 4: Educational Status Of Patients

Figure 4 gives the diagrammatical representation of the educational status of the total number of patients who were enrolled in the study. About 78% of all the patients were educated to a considerable level and 22% of all the patients were uneducated.

Table 5: Reasons For Admission In The Hospital

Reasons for admission	Frequency	Percentage
Road traffic accident	98	48.51%
Osteoarthritis	37	18.31%
Slip and fall	33	16.33%
Disc herniations	09	4.45%
Other	25	12.37%

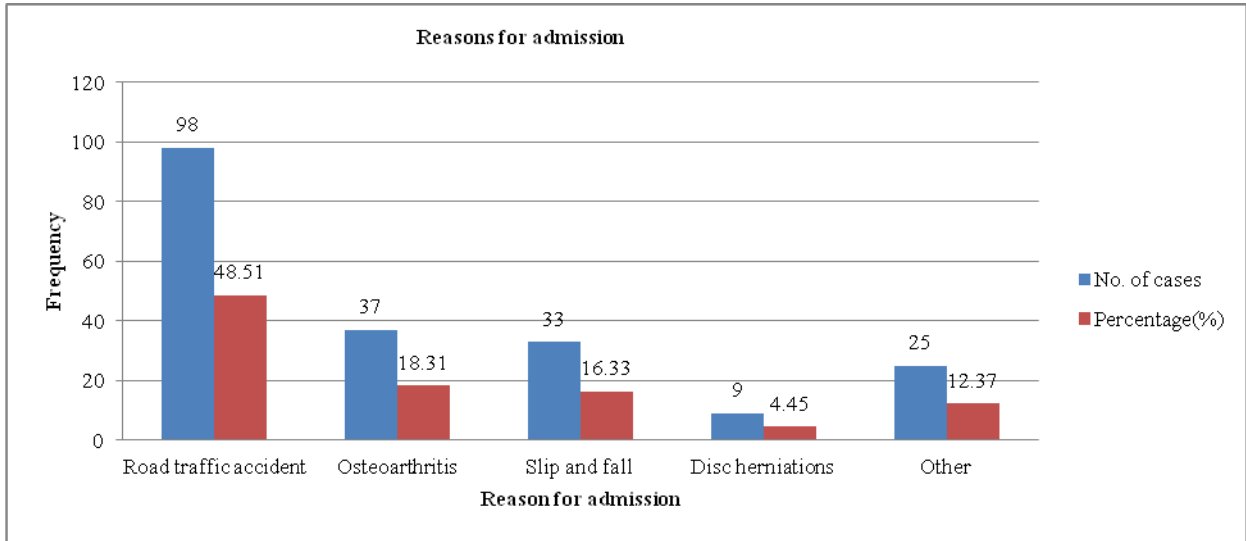


Figure 5: Reasons for admission

Figure 5 shows the graphical representation of various reasons for admission into the orthopedic ward. Among all the cases enrolled in the study, the occurrence of a Road Traffic Accident(RTA) was found to be higher when compared to other reasons with a frequency of 98 out of 202 cases (48.51%). Osteoarthritis and slip and fall cases were also seen in considerable numbers with a frequency of 37 (18.31%) and 33(16.33%) cases respectively, followed by other reasons that include implant removals and workplace injuries with a frequency of 25 (12.37%) and a few cases of disc herniations were also seen at a rate of 4%.

Table 6: Antibiotics Given To Patients Who Have Undergone Surgery In Orthopaedic Department-Single Drug Regimen

Drug	Prophylaxis	Treatment	Frequency
Monocef	52	3	55
Cefotaxime	14	13	27
Cefuroxime	0	12	12
Piperacillin	0	6	6
Amoxicillin	1	1	2
Amikacin	0	03	3

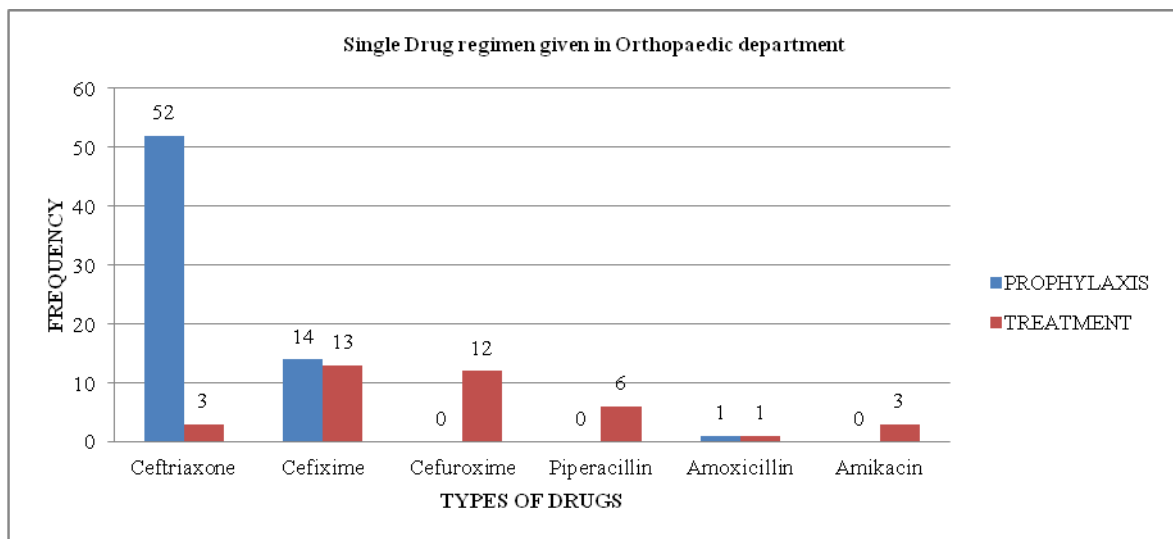


Figure 6: Single Drug regimen given in Orthopaedic department

Figure 6 Shows the graphical representation of various antibiotics given to patients who have undergone surgery in orthopaedic department. Among all the cases enrolled in the study Ceftriaxone was found to the most commonly administered drug as a prophylactic agent with a frequency of 52, followed by cefixime with a frequency of 14. Cefotaxime was also commonly given to patients in post operative conditions with a frequency of 14, followed by cefuroxime with a frequency of 12 and piperacillin with a frequency of 6.

Table 7: Antibiotics Given To Patients Who Have Undergone Surgery In Orthopaedic Department-Multiple Drug Regimen

Multiple drug regimen	Frequency	Percentage
Piperacillin+Amikacin	15	9.14%
Cefuroxime+Amikacin	30	18.29%
Ceftriaxone+Metronidazole	49	29.87%
Piperacillin+Metronidazole	2	1.21%
Cefixime+Metronidazole	23	14.02%
Cefuroxime+Metronidazole	19	11.58%
Piperacillin+Clindamycin	1	0.60%
Cefoperazone+Metronidazole	10	6.09%
Amoxicillin+Cefixime	1	0.60%
Amikacin+Metronidazole	7	4.26%
Amoxicillin+Metronidazole	3	1.82%
Ceftriaxone+Metronidazole+Amikacin	3	1.82%
Cefixime+Metronidazole+Gentamycin	1	0.60%

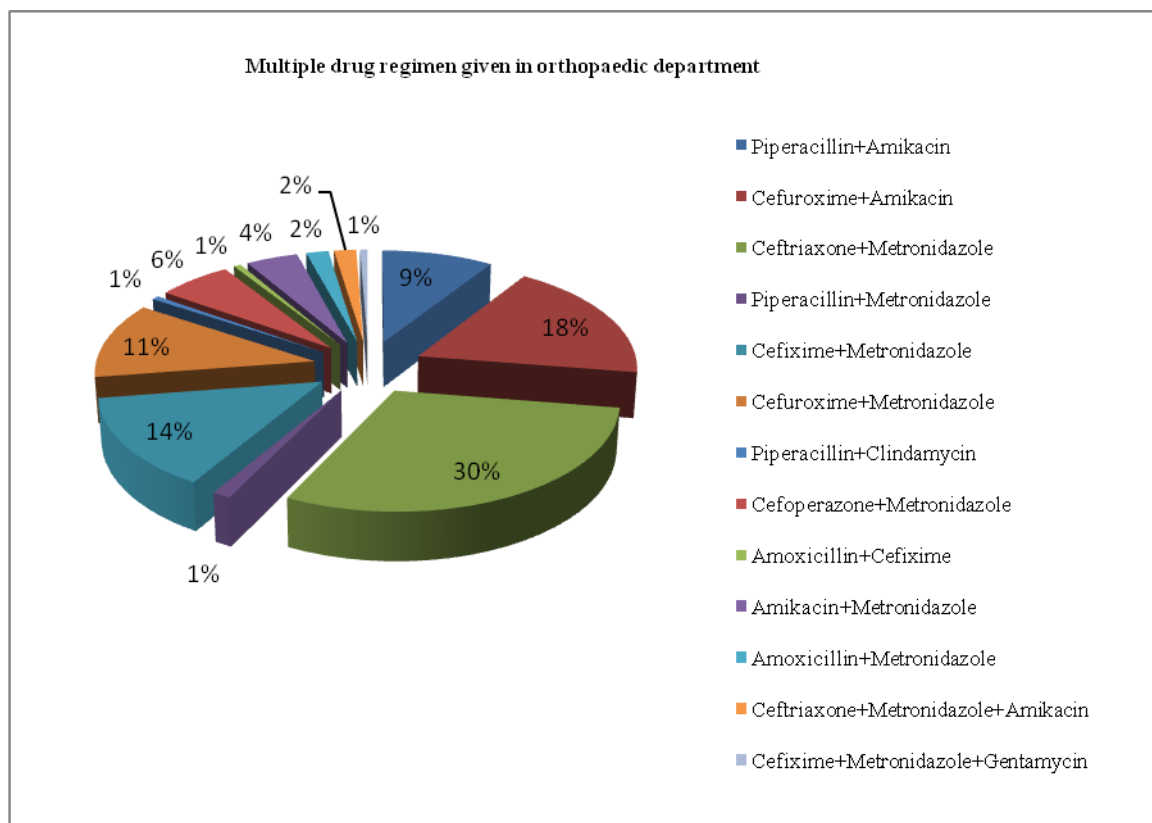


Figure 7: Multiple drug regimen is given in the orthopaedic department

Figure 7 shows the diagrammatical representation of various antibiotics given to patients who have undergone surgery in the orthopedic department. Among all the enrolled cases in the study majority of patients were given Ceftriaxone with Metronidazole with a frequency of 49 out of 202 patients i.e, 30% of the total number of patients were given this regimen. A total of 30 patients were given Cefuroxime with Amikacin with a percentage of 18% of all the patients, this is followed by Cefixime with Metronidazole with a percentage of 14%, Cefuroxime with Metronidazole with a percentage of 11%, and Piperacillin with Amkacin with a percentage of 09%. These were the drugs that were given to patients most frequently.

Table 8: Most Frequently Considered Classes Of Antibiotics

Class of antibiotic	Frequency	Percentage
Cephalosporins	163	80.69%
Penicillins(beta-lactams)	29	14.35%
Aminoglycosides	59	29.20%
Nitroimidazoles	117	57.92%

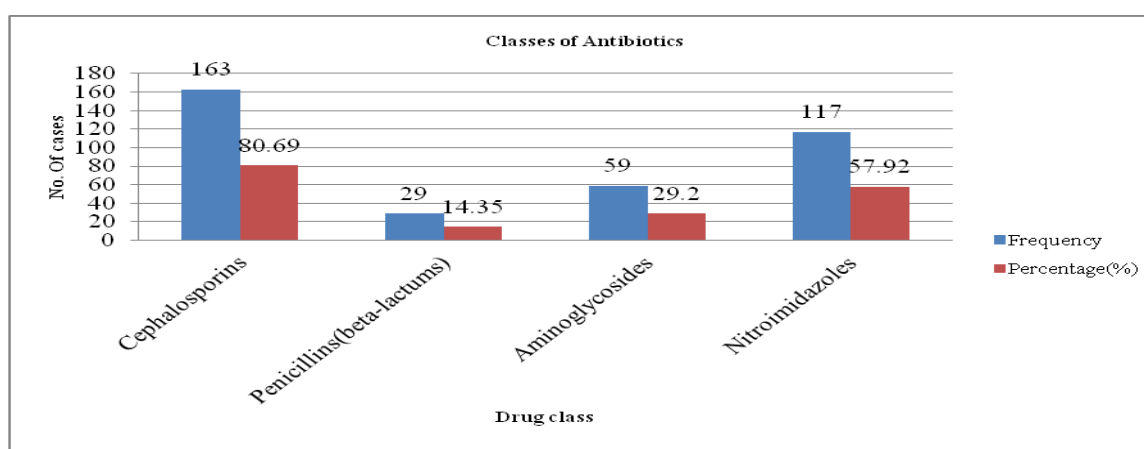


Figure 8: Classes of Antibiotics

Figure 8 shows the graphical representation of various classes of antibiotics used in the orthopedic ward with their frequencies and percentage of use. Among all the cases enrolled in the study majority of the patients were given Cephalosporin antibiotics in combination with nitroimidazole antibiotics (Metronidazole) and hence the higher frequency of these classes I.e, 163, and 117 respectively. Cephalosporins were also found to be given alone and also for prophylactic purposes as shown in the table. Most of the other classes of drugs were also given in combinations as shown in table.

IV. DISCUSSION

It is a prospective study carried out in different tertiary care Orthopaedic hospitals in Karimnagar for a period of 6 months. A total of 202 cases were collected in the inpatient department. The following evaluations were made from the data collected. Among all the patients enrolled in the study, male patients were found to be more in number i.e, 137 when compared to female patients i.e, 67, and the percentages for the same were found to be male (66.83%) and female(33.16%). majority of patients were found to be in the age group of 30-40 (45 patients) followed by 50-60(41 patients), 40-50 (35 patients), 20-30(33 patients), 60-70(25 patients), 70-80 (20 patients) and the least number of patients were found to be in the age group of 15-20(3 patients). while the majority of patients were males, in the age group of 50-60 females were found to be higher than males (in the ratio of 24:17) suggesting that more females have been admitted to the hospital and the main reason for admission being Osteoarthritis due to various household works carried out by women and age factors. In the remaining age groups, males were found to be higher in number and the reasons for admission to the hospital were Road Traffic Accidents(RTA) and injuries at the workplace. About 78% of all the patients were educated to a considerable level and 22% of all the patients were uneducated.

NILAY SOLANKI et al., 2019 Conducted a study on drug utilization patterns and a Drug Interaction study of Antibiotics prescribed to orthopedic patients in private hospitals. The study analyses Accident cases were the most common condition in our study followed by Osteoarthritis. In our study, 22% of drugs were prescribed by generic names. Prescribing medicines by generic names would help in less expensive treatment. The number of medicines per prescription should be kept to a minimum. The average number of antibiotics must be kept within the limit as per WHO criteria; in other words, the rational use of antibiotics must be strictly followed. No serious

drug interaction was found. Mostly all the possible drug interactions occur through the pharmacokinetic mechanism.

Similarly in the present study Road Traffic Accident (RTA) was found to be the major reason for bone fractures and admission into the hospital with a frequency of 98 of 202 cases (48.51%) when compared to other reasons. Osteoarthritis and slip and fall cases were also seen in considerable numbers with a frequency of 37(18.31%) and 33 (16.33%) cases respectively, followed by other reasons that include implant removals and workplace injuries with a frequency of 25 (12.37%) and a few cases of disc herniations were also seen at a rate of 4%.

Dinesh Kumar Yadav et al., in 2020 conducted a study on the Utilization pattern of Antibiotics and Drug-related problems in the Orthopedic department at a tertiary care hospital: a prospective study. The study showed that ceftriaxone was the most frequently prescribed antibiotic. Generic prescribing is urgently needed for cost minimization. The prevalence rate of ADR occurrence and DDI was high. The number of medicines per prescription should be kept to a minimum. The study found benefits the hospital policymakers to formulate and address policies rational use of antibiotics. monitoring of antibiotic use will eventually result in optimizing antibiotic prescription and the implementation of national strategies to improve patient safety. Pharmacists Continuous should be appointed to develop and implement surveillance systems in the hospital and to promote rational prescribing.

In our study Ceftriaxone was found to be the most commonly administered drug as a prophylactic agent with a frequency of 52, followed by cefixime with a frequency of 14. Cefotaxime was also commonly given to patients in post-operative conditions with a frequency of 14, followed by cefuroxime with a frequency of 12, and piperacillin with a frequency of 6.

Among all the enrolled cases in the study, the majority of patients were given Ceftriaxone with Metronidazole with a frequency of 49 out of 202 patients I.e, 30% of the total number of patients were given this regimen. A total of 30 patients were given Cefuroxime with Amikacin with a percentage of 18% of all the patients, this is followed by Cefixime with Metronidazole with a percentage of 14%, Cefuroxime with Metronidazole with a percentage of 11%, and Piperacillin with Amkacin with a percentage of 09%.

These evaluations suggest that the majority of patients were given Cephalosporin antibiotics in combination with a nitroimidazole(Metronidazole) and hence the higher frequency of these classes I.e, 163, and 117 respectively. Cephalosporins were also found to be given alone and also for prophylactic purposes. Most of the other classes of drugs were also given in combinations.

V. CONCLUSION

Ceftriaxone with Metronidazole was found to be the most frequently used antibiotic regimen given to patients in post-operative conditions, about 30% of the total number of patients were given this regimen. This is followed by Cefuroxime and Amikacin with a percentage of 18% of all the patients, this is followed by Cefixime and Metronidazole with a percentage of 14%, Cefuroxime and Metronidazole with a percentage of 11%, and Piperacillin with Amkacin with a percentage of 09%. The Cephalosporin class of antibiotics in combination with nitroimidazole antibiotics (Metronidazole) were found to be most commonly used. We conclude through our study that the cephalosporin class of drugs was the most commonly used drug in the orthopedic department because of their safety and efficacy, and all the antibiotics that were given are being used appropriately to ensure positive patient outcomes and improve the overall health status of the patient.

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