Original Article

Assessment Of Rational Use Of Antimicrobial In Orthopaedic Procedure

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Abstract

Background: From a clinical perspective, proper use of antimicrobial experts is essential. Current anti-microbial drugs play a vital role in both the prevention and treatment of irresistible illnesses, making them one of the most important agents for therapeutic evaluation. Without a doubt, there is a problem with their abuse globally, with underdeveloped countries experiencing it to a greater extent.

Objective: evaluation of the therapeutic and preventive use of antibiotics in patients who have had orthopaedic surgery.

Methodology: On 150 clinical records of orthopaedic patients who underwent medical procedure, an immediate and observational review was done.

Result: This study included information from 150 people, including 80 men and 70 women who had orthopaedic surgery. Cephalosporins (73.36%) and cefuroxime (62.62%) were found to be the antimicrobial classes most frequently utilised for prophylaxis and therapy, respectively. Nearly 50% of prophylactic cases were found to be unsuitable, whilst approximately 70% of antibiotic treatments failed to adhere to recommendations.

Conclusion: This study includes the maximum number of patients from total hip replacement surgery and open reduction internal fixation (ORIF), respectively. The study's findings showed that some surgical prophylaxis during orthopedic operations was somewhat improper.

Keywords: Antibiotics, Surgery, Prophylaxis, Investigation, Inappropriateness, ORIF.

INTRODUCTION

For bacterial infections to produce less morbidity and mortality, antibiotics must be used wisely. However, because antibiotics are frequently prescribed irrationally, there can be negative drug events, poorer health outcomes, resource waste, economic burden, unneeded environmental damage, and the emergence of antibiotic resistance [1–4].

According to clinical theory, antimicrobial operators make up one of the important groups and play a crucial role in both prevention and treatment, separately. The reports suggest that several factors, such as their availability, guarantee, and genuine use, are important considerations. The problems associated with the misuse of antibiotics without professional assistance are the main cause of microbial resistance in many underdeveloped countries. [5]

Prophylactic antibiotics are widely employed in medical treatments and are documented as a lenient anti-contamination agent in various crisis facilities. The goal of surgical antimicrobial prophylaxis is to decrease the inappropriate use of anti-infection drugs in the prevention of infections at or near the surgical antimicrobial prophylaxis (SAP). Prophylactic antibiotic treatments can decrease hospitalisation costs for a variety of medical procedures that are impacted negatively by surgical site infections (SSI). Antibiotic resistance can be lowered in this way by using prophylactic antibiotics carelessly or arbitrarily. [6] They have an impact on the mortality and morbidity of patients and considerably increase the financial burden. To prevent both post-operative infections and the development of antibiotic resistance, preoperative anti-microbial drugs must be used while adhering to antimicrobial guidelines. [7] Antimicrobial prophylaxis' timing, dosage, and duration are crucial factors in preventing antibiotic resistance because it is thought to be most effective when administered about an hour before surgery. [8] Studies have shown that in the presence of bacterial problems, antibiotics must work dynamically against key expected pathogens, and have almost certainly attained the requisite concentration in the tissue or body fluids in risk. While anti-microbial prophylactic activities have been ongoing, it has been unclear whether or not they should. [9] An extensive amount of inappropriate antimicrobials are used for patients who are admitted to the surgery ward, according to earlier studies done around the globe. These studies have also identified potential causes of inappropriate usage, such as prolonged courses of therapy, lack of good organisation, medication selection that is insufficient in terms of antibacterial diversity, and the needless use of two different anti-infection agents. [10-13] Recommendations for incorrect behaviour and usage of anti-infection drugs contribute to the problem. Inappropriate antibiotic use is a worldwide problem in the healthcare system, but it is more pervasive in developing countries. .[14-20] By identifying unethical use of drugs, particularly antibiotics for prophylaxis and treatment in surgical wards, this study serves as a benchmark for health authorities and policymakers, aids in the development of systems that control drug overuse, and reduces the financial burden on clinics by simply adhering to the rules for managing emergency clinics. [21-23]

MATERIALS AND METHODS

Study setting: The orthopedic ward of a hospital with tertiary consideration was choosen for this investigation. The test was scheduled to take place between September 2019 and December 2019.

Study design: It is a prospective, observational study, where the individuals' medical records are examined to glean information from the sample through randomization.

Source populace: Every patient's clinical file who underwent a substantial medical operation between May and August of 2022.

Eligibility criteria

Inclusive criteria: The study contains both clean and contaminated operations that were chosen at random. Patients having orthopaedic surgery, regardless of their age or gender.

Exclusive criteria: Patients with diabetes, minor wounds, confirmed microbiological contamination, and instances of pregnancy were excluded from the research. Sample size: The preceding formula was used to calculate the minimum demonstrably necessary sample size.

$N= Z\ 2\ P\ (1-P)D^2$

Where:

N=Sample size required P=Prevalence pace of antibiotics

Z=The standard typical Confidence at interim of 95% =1.96

D=The edge of testing blunder endured

Sampling techniques

In this instance, stratified random sampling was used as a suitable technique to obtain a final relevant sample. .[24-25]

Study variables

Independent variable:

Age of the patients, gender, and kind of operation, as well as location, the usage of antibiotics, and length of hospital stay, are each considered independent variables.

Dependent variable

Appropriateness of antibiotic use.

Data collection procedure

A well defined Performa is made to gather the pertinent data required for investigation.

Data quality control:

The position of information gathering was accepted with its aim in mind and sufficiently broadened to satisfy the assessment's objective in order to raise the investigation's degree of accuracy. This position was pre-tested on approximately 5% of patient cards from a comparable source population before beginning actual information gathering. ; these cards were not taken into account in the current investigation. Regular tests for accuracy and consistency of the information were also maintained. Utilizing a two-fold approach, SPSS® software was used to ensure the consistency and validity of the data collected [26–27].

Data analysis and presentation:

The data was categorised and analysed using SPSS version 20.0, a statistical package specifically designed for social scientists. Questions were asked in order to get to the bottom of the situation. Using tables and diagrams, the result was decomposed and displayed. The information that was available was analysed and discussed using the findings of comparative studies. [28-29]

Ethical considerations

To obtain permission to lead the study, a formal letter was addressed to the Tertiary Hospitals, and the medical clinic organisation gave its official approval. The names and other identifiers of patients and prescribers were not recorded on the information reflection groups in order to ensure confidentiality.

RESULT AND DISCUSSION

The investigation was carried out while taking several parameters into account. The findings are displayed in tabular fashion, with each parameter receiving specific attention. The following section included a more in-depth discussion. The following outcomes were attained:

Socio- demographic characteristics

150 patients who have had orthopaedic procedures are examined in total. The number of patients was divided into four age groups: 30–40 years, which contributed about 36.66%; 41–50 years, which contributed nearly 20; 51–60 years, which contributed nearly 28.66%; and finally, those who were older than 60 years.

Table 1: Representation of socio-demographic characteristics along with inappropriateness of antibiotics for orthopedic patients during May 2022 to August 2022

Sl. No.	Socio-demographic characteristics	Frequency N (%)	Inappropriateness of antibiotic used	
			For Prophylaxis N (%)	For Treatment N (%)
Age group				
1	30-40	55 (36.66)	27 (36)	41 (39.04)
	41-50	30 (20)	21 (28)	26 (24.76)
	51-60	43 (28.66)	17 (22.67)	24 (22.85)
	> 60	22 (14.66)	10 (13.33)	14 (13.33)
Total		150 (100)	75 (100)	105 (100)
Sex				
2	Male	80 (53.33)	52 (69.33)	65 (61.90)
	Female	70 (46.66)	23 (30.66)	40 (38.09)

N- is the number of patient

Therapeutic Indication

Surgical treatments such as total knee replacement, skin grafting, and closed reduction-internal fixation (CRIF) are only a few examples. wound debridement, arthroplasty, implants, and ORIF, were used in the current study. As shown in Table 2, the majority of cases were also discovered to belong to only open reduction and internal fixation (ORIF) (40%) and complete hip replacement (20%).

Table 2: Diagnosis of orthopedic patients who underwent surgery at Tertiary care hospital from May 2022 to August 2022

Diagnosis	Frequency	Percentage (%)
ORIF	60	40
Total Hip Replacement	30	20
Wound Debriment	15	10
Arthroplasty	12	8
Implants	11	7.33
CRIF	12	8
TKR	06	4
Skin grafting	04	2.66
Total	150	100

No. of antibiotics prescribed for prophylaxis and treatment

Cefuroxime, a member of the 2nd generation cephalosporin family, was discovered to be the most often given antibiotic during the study. The statistics revealed that almost 62.62 and 54.42% of its consumptions for prophylaxis and treatment, respectively, were recorded, followed by amikacin 14.64% and 14.60%. Table 3 shows the detailed information.

Table 3: Representation of Total antibiotics used for surgical prophylaxis and treatment

Drug name	Prophylaxis No of patients N (%)	Treatment No of patients N (%)
Cefuroxime	124 (62.62)	123 (54.42)
Amikacin	29 (14.64)	33 (14.60)
Metronidazole	12 (6.06)	16 (7.07)
Amoxicillin potassium clavulanate	06 (3.03)	06 (2.65)
Ceftriaxone	07 (3.53)	04 (1.76)
Cefoperazone salbactum	05 (2.52)	04 (1.76)
Cefuroxime/ clavulanic acid	04 (2.02)	30 (13.27)
Levofloxacin	04 (2.02)	03 (1.32)
Linezolid	04 (2.02)	05 (2.21)
Cefotaxime	03 (1.51)	02 (0.88)
Total	198 (100)	226 (100)

Antibiotic regimen (Single/ Multiple)

A total of 81 (54%) and 21 (12.80%) patients were administered a single regimen for prevention and therapy, respectively. Additionally, it was discovered that the percentage of single regimens in the treatment regimen was much lower than that of prophylaxis. The two-drug regimen has been administered to 35 patients (23.33%) for prophylaxis and to nearly 98 patients (59.76%) for treatments. In all situations, it was around 15.85% at the time of the three-drug regimen. However, it was found to be 9 (6%) and 19 (11.58%), respectively, for the therapy of four medications, as shown in Figure 1.

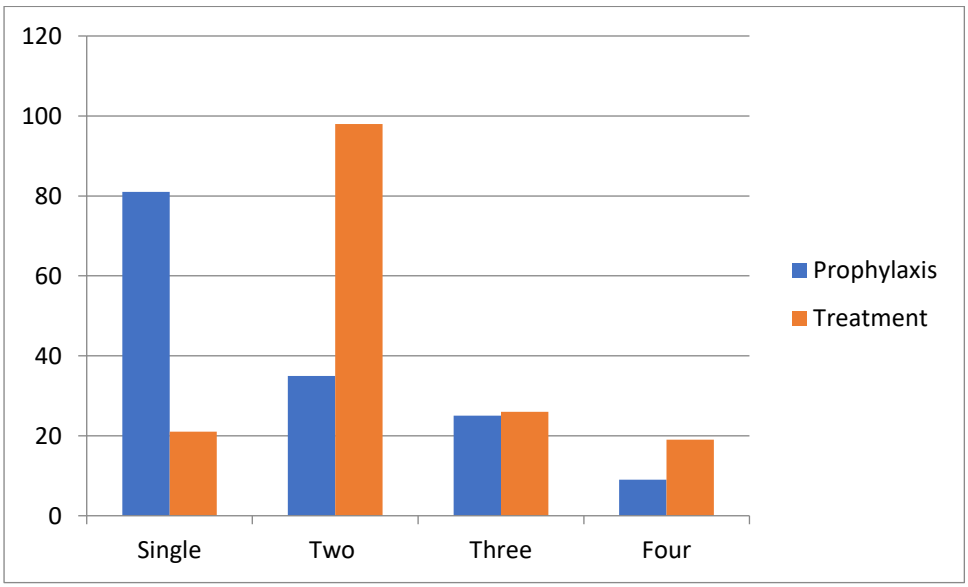

Figure 1: Showing the antibiotic regimen used for prophylaxis and treatment in orthopedic procedures.

Appropriateness of antibiotics

About 50% of the antibiotics used for prophylaxis were determined to be appropriate. However, as evidenced by data in Table 4, adherence to conventional recommendations was just 27% when it came to therapy.

Table 4: Representation of appropriateness of antibiotic in orthopaedic surgery at tertiary care hospital

Reason for use	Appropriateness	Frequency	Percentage (%)
Prophylaxis	Appropriate	75	50
	Inappropriate		
	Inappropriate choice	37	24.66
	unnecessary combination	38	25.33
	Total	75	50
Treatment	Appropriate	40	26.92
	Inappropriate		
	Excessive duration	45	30
	Short duration	4	2.66
	Inappropriate choice	6	4
	unnecessary combination	50	33.33
	Total	105	70

Single regimen

Ceftriaxone was discovered to be the most often given antibiotic, as seen in Table 5. Our findings show that prevention and therapies are supported by nearly 98.82 and 87.73% of the population, respectively.

Table 5: Antibiotics regimen (single) prescribed for patients at Tertiary care Hospitals May 2022 to August 2022.

Antibiotic used	Prophylaxis No of patients N (%)	Treatment No of patients N (%)	Total N (%)
Ceftriaxone	168 (98.82%)	93 (87.73%)	261(94.56)
Ampicillin	2 (1.17%)		2 (0.07%)
Norflaxacillin	-	13 (12.26%)	13(4.71)
Total	170 (100)	106 (100)	276 (100)

Combination regimen

Many different antibiotic combination regimens were used for prophylaxis, including Ceftriaxone+ Amikacin+ Cefuroxime (18.18%), Metronidazole + Ampicillin+ Cefuroxime (15.90%), Ceftazidine + Amikacin (15.90%), and Flouroquinoloes + Amikacin (15.90%). For treatment, Ceftrixone + Cefuroxime (28.57%), Ceftrix Table 6 displays the pertinent information in detail.

Table 6: Antibiotic combination regimen used for prophylaxis and treatment

	Antibiotic combination	Frequency	Percentage (%)
For Prophylaxis	Ceftriazone+ Amikacin+ Cefuroxime	8	18.18
	Metronidazole+Amikacin+ Cefuroxime	7	15.90
	Ceftazidine+ Amikacin	7	15.90
	Flouroquinoloes + Amikacin	7	15.90

	Levoflaxacin+ Metronidazole +Amikacin	5	11.36
	Flouroquinoloes +Amikacin+ metronidazole	4	9.09
	Ceftazidine+ Amikacin+ cefixime	3	6.81
	Ceftazidine+ Amikacin+ Ceftrixone	3	6.81
	Ceftrixone+ cefuroxime	3	6.81
	Total	44	100
For Treatment	Ceftriaxone+ Cefuroxime + clavunalic acid	18	28.57
	Ceftriaxone+Metronidazole +Amikacin	13	20.63
	Cefoperazone +cefuroxime /clavinolic acid	8	12.69
	Metronidazole+ Amikacin	7	11.11
	Levofloxacin + Metronidazole +Amikacin	5	7.93
	Amikacin+ Ceftriaxone	5	7.93
	Levoflaxacin + Amikacin	4	6.34
	Ceftazidine+ Amikacin +Cefuroxime	3	4.47
	Total	63	100

Antibiotic Class prescribed

In the market, there are a lot of different antibiotics. According to our findings, only cephalosporins (more than 73%) and penicillins (greater than 15.76%) were typically administered for prophylactic and treatment cases, as shown in Table 7.

Table 7: Commonly prescribed antibiotic regimen orthopaedic surgery

Class of antibiotic	For prophylaxis N (%)	For treatment N (%)	Total (%)
Cephalosporin's	135 (73.36)	159 (73.61)	294 (73.5)
Penicillin's	29 (15.76)	33 (15.27)	62 (15.5)
Nitro imidazole	12 (6.52)	16 (7.40)	28 (7.0)
Oxazolidinone antibiotic	4 (2.17)	5 (2.31)	9 (2.25)
Fluoroquinolones	4 (2.17)	3 (1.38)	7 (1.75)
Total	184 (100)	216 (100)	400 (100)

DISCUSSION

In the current study, the appropriate selection of antibiotics for prophylaxis is 75 (50%), while the inappropriate selection is based on the selection of antibiotics 37 (24.66%) and the unnecessary combination of antibiotics 38 (25.33%). When it comes to treatment, the appropriate selection of antibiotics is 40(26.92%), while the inappropriateness is based on the excessive duration of 45 (30%), the short duration of 4(2.66%), the inappropriate selection of antibiotics 4(6%), and the unnecessary combination of antibiotic (Table 4)

In current examination the most endorsed antibiotic were Cefuroxime 124 (62.62, Amikacin 29(14.64) Metronidazole 12(6.06%), Amoxicillin 6 4 (2.02) (3.03), Ceftriaxone 7 (3.53%), Cefoperazone salbactum 5 (2.52%), Cefuroxime/ clavulanic acid, Levofloxacin, Linezolid 4 (2.02) and Cefotaxime 3 (1.51) for prophylaxis and 54.42%, 14.60%, 7.07, 2.65, 1.76, 1.76, 13.27, 1.32, 2.21 and 0.88 for treatment respectively. The prophylactic antimicrobial regimens included both single just as mix regimens; single regimens in prophylaxis took the lion's offer. Right now most usually endorsed routine among the mix regimens was Ceftriazone+ Amikacin+ Cefuroxime (18.18%) for prophylaxis and Ceftriaxone+ Cefuroxime + clavunalic acid for treatment (28.57%) for treatment (Table 6). This examination uncovered orthopedic medical procedure for prophylaxis were cephalosporin 135 (73.36), trailed by Penicillin's 29 (15.76) and Nitroimidazoles 12 (6.52), Oxazolidinone antibiotic 4 (2.17%), Fluoroquinolones 4 (2.17) (Table 7).

The complete number of patients who were treated with mono therapy of anti-microbial medications for prophylaxis were Ceftriaxone 168 (98.82%), Ampicillin 2 (1.17%), and for the treatment Ceftriaxone 93 (87.73%) and Norflaxacillin 13 (12.26%) .

Prospective and observational examination, the type of study design we used, is prone to tendencies (errors that affect the impression an examination leaves on the reader); for instance, in the combination of data it is hard to assess how the patients took their drug and if there is any unwanted effect from the prescriptions. Due to the time constraints imposed by the assessment, we neglected to give due consideration to crucial elements such as the extent of training received, the regularity with which it was received, the frequency with which calm prosperity experts corresponded, and In addition, we encountered difficulties due to the small sample size of our model and the fact that this evaluation covered only one crisis referral facility across the country.

CONCLUSION

According to the recent studies, SAP was given to the majority of patients who underwent orthopaedic surgery. The majority of the time, total hip replacement was followed by ORIF, which predominated in most cases (about 40%). On the other hand, because of some problems with incorrect drug selection and administration duration, the practise was not always in line with accepted norms. One of the main causes for this evaluation's limitation is prospective and observational testing. It can be challenging to determine how well individuals received their medications and to spot any negative side effects. We neglected to look at important aspects, such as training level, adherence and calm prosperity pro correspondence, provider and prosperity structure linked factors, because of the anticipated assessment.