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| RESEARCH ARTICLE

An Overview of Pre-Operative and Post-Operative Antibiotic Use in Inpatients in Orthopedic Surgery at Dr. H. Moch. Ansari Saleh Banjarmasin

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| ABSTRACT
Preoperative and postoperative antibiotics are included in prophylactic antibiotics, which aim to reduce the risk of surgical wound infection. Surgical Site Infection (SSI) is one of the problems of healthcare-associated infections (HAIs). Dr. Hospital H. Moch. Ansari Saleh Banjarmasin is a government hospital that provides many orthopedic surgical procedures and has data related to antibiotic use. This study aims to determine the description of the use of antibiotics as preoperative and postoperative prophylaxis. The research method included a descriptive observational study with a cross-sectional design on medical record data of surgical patients at Dr. RSUD. H. Moch. Ansari Saleh Banjarmasin in August–December 2023, which was taken using a purposive sampling technique with a retrospective approach. Results: 133 samples met the inclusion criteria. The majority of patients were aged 17–25 years (25.6%), the gender was predominantly male (62%), the length of stay was at most 2 days (40.6%), the type of surgery was clean (82%), and they did not have comorbidities (83%). Research shows that cefazolin is most widely used as preoperative prophylaxis by 123 people (92%) and postoperatively by 79 people (59.4%). The study concluded that the most widely used antibiotic for patients undergoing orthopedic surgery at RSUD, Dr. H. Moch. Ansari Saleh Banjarmasin, is cefazolin.

| KEYWORDS
Surgical Wound Infection, Prophylactic Antibiotics, Cefazolin, Orthopedic Surgery.

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1. Introduction

Preoperative and post-operative antibiotics are included in prophylactic antibiotics, which aim to reduce the risk of surgical wound infection (Ierano et al., 2017). Based on the definition from the Regulation of the Minister of Health of the Republic of Indonesia Number 28 of 2021 concerning Guidelines for the Use of Antibiotics and the Regulation of the Minister of Health of the Republic of Indonesia Number 8 of 2015 concerning Antibiotic Resistance Control Programs in Hospitals, antibiotic prophylaxis is the use of antibiotics before, during and no later than 24 hours after surgery in cases that clinically do not show any signs of infection to prevent wound infection in the surgical area. (Kemenkes RI, 2021).

Surgical Wound Infection (ILO) is an infection that often occurs in patients undergoing surgical procedures. According to the Centers for Disease Control and Prevention, these infections are categorized into superficial incisional infections, deep incisional infections, and organ/space infections in the wounds of patients undergoing surgical procedures. To be classified as a surgical site infection, the wound must occur within 30 days of surgery, include only the skin, subcutaneous tissue, deep layers or distant organs, and have purulent drainage or organisms isolated from the wound site (Zabaglo M et al., 2023) Surgical Wound Infection (ILO) is one of the problems associated with Healthcare-Associated Infections (HAIs). The problem of surgical wound infection will affect morbidity and mortality in post-operative patients (Alsaeed et al., 2022).

Surgical wound infections are widely reported in several countries. A World Health Organization (WHO) survey reported that the incidence of surgical wound infections worldwide ranges from 5% to 15% (World Health Organization, 2015). This incidence in developing countries reaches a range of 11.8 incidents out of 100 surgical procedures (Pathak, 2017). According to the Ministry of Health of the Republic of Indonesia, in 2011, surgical wound infections in government hospitals in Indonesia amounted to 55.1% (Asyifa, 2017).

Several studies have identified many risk factors that cause surgical wound infections, such as diabetes, smoking habits, systemic use of steroids, obesity, old age, poor nutritional status, infections at poorly vascularized wound sites, or colonization. *Staphylococcus aureus*, as well as blood transfusions during perioperative. The type of prophylactic antibiotics used is considered one of the most important methods for reducing the risk of these infections. (Neumayer et al., 2007), (Halawi et al., 2018).

RSUD Dr. H. Moch. Ansari Saleh Banjarmasin is a government hospital that provides many surgical procedures, including orthopedic surgery. Orthopedic surgery performed at this hospital includes Open Reduction Internal Fixation, Open Reduction External Fixation, Arthroscopy, Arthroplasty, ligament reconstruction, removal implant, amputation and debridement and various other types of operations. According to the medical records unit report for January – October 2022, the surgery removal implant occupied the highest position compared to other types of orthopedic surgery, namely 184 patients. All orthopedic surgical procedures carry a risk of infection. Thus, preoperative and post-operative antibiotics are standard in implant installation procedures, removal implants, and other major surgeries that require blood or are expected to involve much blood loss. (Crader, 2023).

Providing appropriate antibiotics based on bacterial patterns or empirical research is important in reducing the risk of surgical wound infections. Therefore, the administration of antibiotics for surgical procedures should ideally follow guidelines for prophylactic antibiotics or local guidelines based on hospital bacterial patterns. (Ierano et al., 2017), (Kemenkes RI, 2021), (Kemenkes RI, 2015).

Organisms that cause infections that are often found at orthopedic surgical sites include *staphylococcus aureus, staphylococcus epidermidis, streptococci aerob, cocci anaerob*. Other causes, such as *cutibacterium acnes* (formerly *Propionibacterium acnes*), are also found in post-shoulder surgery infections (Tan et al., 2017). In one study at the Kashani Trauma Center Hospital in 2011-2020, 5950 patients underwent surgery closed fracture, and 238 (4%) patients were readmitted due to infection. Data from 157 patients were analyzed, and it was found that the most common site of infection was the knee in 46 patients (29.3%). Data also showed that gram-positive bacteria were detected in 55 patients (56.7%), while gram-negative microorganisms were found in 42 patients (43.3%). (Motififard, 2021).

Preoperative and postoperative antibiotic use is often based on the anatomical area undergoing the surgical procedure. [1] When determining the use of antibiotics, the desired outcome is to kill a narrower spectrum of bacteria and ensure that commonly found organisms can also be targeted. Prophylactic antibiotics are selected depending on many factors, including cost, safety profile, ease of administration, the drug's pharmacokinetic profile, bactericidal strength, and resistance patterns in the hospital. If these factors can be maximized, surgical site infections can be reduced. (Varacallo, 2018).

Cefazolin is often used as orthopedic surgical prophylaxis in patients who do not have a history of beta-lactam allergy or in patients who are not infected. *Methicillin-resistant Staphylococcus aureus* (MRSA). Then, for patients who experience allergies to cefazolin when used as preoperative prophylaxis, clindamycin or lincomycin are often used as alternatives to replace its role. In case of infection *Methicillin-resistant Staphylococcus aureus* (MRSA), or patients who have a high risk of infection *Methicillin-resistant Staphylococcus aureus* (MRSA) such as patients living in nursing homes, or patients with a history of previous MRSA infections, vancomycin is an alternative (Bosco et al., 2010). Several antibiotic options, including cefazolin, metronidazole and aminoglycosides, may be considered (Lukito, 2019). However, additional antibiotics should be considered based on the surgical site, hospital antibiotic resistance and patient profile.

The high use of antibiotics will give rise to many problems and become a new threat to treatment, especially bacterial resistance. The impact will be seen in morbidity and mortality and will become a new problem from an economic and social perspective. So, an evaluation measure is needed to reduce the irrational use of antibiotics, which will give rise to bacterial resistance and surgical wound infections. (Purwanti, 2014), (O' Neil, 2014).

RSUD Dr. H. Moch. Ansari Saleh Banjarmasin has data related to the description of antibiotic use in orthopedic surgery patients. Based on the background above, research conducted at RSUD by Dr. H. Moch. Ansari Saleh Banjarmasin aims to determine the description of the use of antibiotics as preoperative and postoperative prophylaxis in patients undergoing orthopedic surgery.

2. Method

The research used a cross-sectional descriptive observational research design and a retrospective approach. The research subjects used the medical record status of orthopedic surgery inpatients at Dr H. Moch. During August-December 2023, Ansari Saleh Banjarmasin used purposive sampling techniques, namely, the sampling technique is limited to certain types to provide the information the researcher wants and fulfill the criteria determined by the researcher (Sekaran et al., 2017). Samples that met the inclusion criteria were patients who received orthopedic surgery and were given antibiotics, and complete medical records with a list of preoperative and postoperative antibiotic therapy.

The collection of medical record data and the selection process in this study is described in the form of a Flowchart in picture 1:

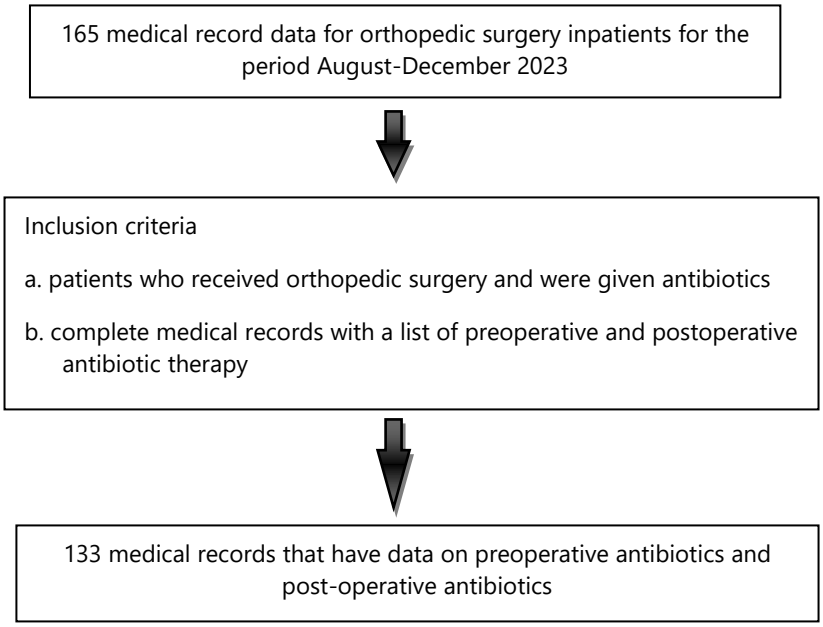

Figure 1. Flowchart Retrieval of research data

The operational definition of clean surgery is surgery performed in an area that does not have an infection, does not open channels (gastrointestinal, bile, urinary, respiratory tract), planned surgery, or primary skin closure with/without using a closed drain, for example, surgery Open Reduction Internal Fixation in close-up of a bone fracture resulting from trauma, Arthroscopy, Arthroplasty, removal implant. Meanwhile, contaminated surgery is surgery carried out on open wounds after passing through the golden period or open wounds more than four hours after an incident involving an acutely inflamed area (non-purulent), for example, Open Reduction External Fixation in open bone fractures due to trauma, amputation and debridement of open wounds. (Kemenkes RI, 2021), (Kamel et al., 2011)

Data is entered into the data collection sheet using software Microsoft Excel. The data contains patient identity, length of stay, diagnosis, surgery and antibiotics used. Data analysis from research results used univariate analysis.

3. Results and Discussion

3.1 Patient Demographic Data

Table 1. Characteristics of Inpatients

No.	Variable	Number of patients (n)	Percentage (%)
1.	Age		
	0-5 years	4	3,0%
	5-11 years	10	7,5%
	12-16 years old	22	16,5%
	17-25 years old	34	25,6%
	26-35 years old	20	15,0%
	36-45 years old	8	6,0%
	46-55 years old	16	12,0%
	56-65 years old	9	6,8%
	>65 years	10	7,5%
2.	Gender		
	man	83	62%
	Woman	50	38%
3.	Length of hospitalization		
	1 day	6	4,5%
	2 days	54	40,6%
	3 days	39	29,3%
	4 days	16	12,0%
	5 days	8	6,0%
	6 days	4	3,0%
	≥7 days	6	4,5%
4.	Type of operation		
	clean	109	82%
	contaminated	24	18%
5.	Comorbidities		
	There isn't any	110	83%
	one or more types	23	17%

Orthopedic surgery inpatients obtained in research at RSUD Dr. H. Moch. Ansari Saleh Banjarmasin in August-December 2023, as many as 165 people and 133 people met the inclusion criteria. The research sample based on the characteristics of inpatients (table 1) consisted of 50 female patients (38%) and 83 male patients (62%). The age distribution of inpatients is classified according to the Ministry of Health as follows: 1) Toddler period: 0–5 years 4 people (3%); 2) Childhood: 5–11 Years 10 people (7.5%); 3) Early Adolescence: 12–16 Years 22 people (16.5%); 4) Late Adolescence: 17–25 Years 34 people (25.6%); 5) Early Adulthood: 26–35 Years 20 people (15%); 6) Late Adulthood: 36–45 Years 8 people (6%); 7) Early Elderly: 46–55 Years 16 people (12%); 8) Late Elderly: 56–65 Years 9 people (6.8%); and 9) Seniors: > 65 years 10 people (7.5%).

Younger patients are more widely distributed; this could be influenced because, in other studies, it was stated that motor vehicle accidents and trauma to the bones were the most common mechanisms in younger patients. There are fewer elderly patients because older patients are less likely to have motorized accidents and are more likely to be injured due to falls (Peterson, 2015).

Patients undergoing orthopedic surgery had varying lengths of stay (table 1): 1 day for 6 people (4.5%), 2 days for 54 people (40.6%), 3 days for 39 people (29.3%), 4 days for 16 people (12.0%), 5 days 8 people (6.0%), 6 days 4 people (3.0%), and ≥ 7 days

6 people (4.5%). The most extended hospital stay is two days; patient factors, response to therapy and appropriate use of antibiotics can influence this. Length of stay of six and more than seven days can be influenced by comorbidities. (Gholson, 2017)

The most common type of orthopedic surgery (table 1) was clean surgery, with 109 people (82%), followed by contaminated surgery, with 24 people (18%). The clean operation was carried out at RSUD Dr. H. Moch. Ansari Saleh Banjarmasin is an example of Open Reduction Internal Fixation close to the fracture, Arthroscopy, ligament reconstruction, total knee replacement, total hip replacement, Arthroplasty, removal implant and usually the operation is planned or scheduled as elective. Meanwhile, the contaminated operation was carried out at Dr. H. Moch. Ansari Saleh Banjarmasin is an example of Open Reduction External Fixation in open fractures, amputations, repair tendons, and debridement in open wounds, Usually, the operation is carried out immediately or quickly.

Patients who had comorbidities (table 1) underwent orthopedic surgery as many as 23 people (17%), and patients who did not have comorbidities, as many as 110 people (83%). The influence of patient comorbidities on length of stay in orthopedics is rarely studied, but the most extensive studies focus on total knee arthroplasty and hip fractures. The impact of comorbidities on the length of hospital stay remains unknown for most orthopedic procedures. The most extensive study found that the number of comorbidities significantly increases the cost of care. (Pugely. 2014), (Halawi, 2014), (Nikkel, 2019)

3.2 Postoperative prophylactic antibiotics

The preoperative antibiotics used for orthopedic surgery in patients undergoing orthopedic surgery during August-December 2023 (table 2) were cefazolin in the first generation cephalosporin group as many as 123 people (92%), ceftriaxone in the third generation cephalosporin group as many as 8 people (6%), and ceftazidime, a third generation cephalosporin, in 2 people (2%).

Table 2. Types of preoperative antibiotics

Medicine name	Group	Number of patients (n)	Percentage (%)
Cefazolin	First generation cephalosporin	123	92%
ceftriaxone	Third generation cephalosporin	8	6%
ceftazidime	third generation cephalosporin	2	2%
Dosage regimen			
Cefazolin 300mg Intravena	First generation cephalosporin	2	1,5%
Cefazolin 500mg Intravena	First generation cephalosporin	10	7,5%
Cefazolin 2g Intravena	First generation cephalosporin	21	15,8%
Cefazolin 1g Intravena	First generation cephalosporin	90	67,7%
Ceftriaxone 1g Intravena	Third generation cephalosporin	8	6,0%
Ceftazidim 1g Intravena	third generation cephalosporin	2	1,5%

Cefazolin, as a preoperative prophylactic antibiotic for orthopedic surgery, is most often used in patients at Dr RSUD. H. Moch. Ansari Saleh Banjarmasin (table 2). This can be explained through various previous studies. The choice of antibiotic for orthopedic prophylaxis is generally the first-generation systemic cephalosporin, namely cefazolin 2 grams (children's dose is 30 mg/kgBB). Cefazolin has been proven to suppress the growth and colonization of germs in the skin area where a surgical incision will be made. Cefazolin is also compatible with anesthetic drugs and can suppress bacterial mutations. Cefazolin is recommended for

cases of open fractures and closed fractures (implant placement) based on evidence with category A –high recommendation (highly recommended). (Kemenkes RI, 2021)

Cefazolin is a bactericidal agent that works by inhibiting bacterial cell wall synthesis. Cefazolin is active against most Gram-Positive Bacterial microorganisms: *Staphylococcus aureus, Staphylococcus epidermidis, Streptococcus agalactiae, Streptococcus pneumoniae, Streptococcus pyogenes dan Bakteri Gram-negatif: Escherichia coli, Proteus mirabilis*.26

Ceftriaxone, as a third-generation cephalosporin, was chosen as a preoperative prophylactic antibiotic due to its broad spectrum of action against pathogens and low risk of toxicity.27 Meanwhile, ceftazidime can replace cefazolin when drug stocks are empty and can be considered based on the patient profile and financing. Ceftriaxone and ceftazidime are bactericidal agents inhibiting bacterial cell wall synthesis. Both have activity in the presence of beta-lactamases, both penicillin and cephalosporins, against Gram-negative and Gram-positive bacteria. (Sharon, 2007), (Rebecca, 2018)

In several studies, it was stated that various guidelines do not recommend third-generation cephalosporin antibiotics such as ceftriaxone and ceftazidime for use as prophylactic antibiotics. This is because most of these drugs have a relatively higher price while their activity is lower than cefazolin in preventing bacterial growth of *Staphylococcus sp.* According to WHO, the bacteria most often found to cause wound infections is *Staphylococcus aureus*, which is the most abundant normal flora in the skin. Third- and fourth-generation *cephalosporins* have more potent activity against gram-negative bacteria, so it is hoped that they will be used as therapeutic antibiotics, not as prophylaxis when an infection occurs. (Claire, 2021)

Prophylactic antibiotics are given before surgery. Ideally, 30-60 minutes before tissue incision so that there are already effective antibiotics in the surgical target tissue at the time of incision. Prophylactic antibiotics, according to guidelines, are given in a single dose. The dose recommended in the guidelines is a single dose of 2 grams, which is better than 1 gram of cefazolin for implant surgery. (Sanders, 2020)

Preoperative prophylactic antibiotics aim to prevent colonization or development of bacteria entering the tissue being operated on. Prophylactic antibiotics do not sterilize the surgical target tissue because the body's immune system will resist the bacteria that enter. Prophylactic antibiotics prevent further complications from surgical wound infections with all their impacts, for example, increased length of stay, increased costs of hospital care, additional procedures due to unresolved complications, and increased mortality. (Kemenkes RI, 2021)

3.3 Postoperative Prophylactic Antibiotics

The post-operative antibiotics used for orthopedic surgery in patients undergoing orthopedic surgery during August-December 2023 (table 3) were cefazolin, a first generation cephalosporin, 79 people (59.4%), ceftriaxone, a third generation cephalosporin, 6 people (4.5%), ceftazidime, a third generation cephalosporin, 2 people (1.5%), then a combination of cefazolin and gentamicin, an aminoglycoside, 44 people (33.1%), a combination of ceftriaxone and gentamicin, 1 person (0.8%), as well as a combination of ceftriaxone, gentamicin, and metronidazole in the nitro imidazole group in 1 person (0.8%).

The cephalosporin group is a type of antibiotic that is often used because of its activity as a broad spectrum antibiotic. Effective against *Staphylococcus sp*, the pharmacokinetic mechanism is good, the incidence of side effects is small, and the price is affordable (Bandalović, 2015). In orthopedic surgery cases, first generation *cephalosporins* such as cefazolin are the recommended choice. (Rebecca, 2018).

Table 3. Types of Postoperative Antibiotics by Injection

Medicine name	Group	Number of patients (n)	Percentage (%)
Cefazolin	First generation cephalosporin	79	59,4%
ceftriaxon	Third generation cephalosporin	6	4,5%
ceftazidime	third generation cephalosporin	2	1,5%
Cefazolin + gentamycin	First generation cephalosporin + aminoglycoside	44	33,1%
Ceftriaxon + gentamycin + metronidazol	Cephalosporin third generation + aminoglycosides + nitroimidazole	1	0,8%
Ceftriaxon + gentamycin	Cephalosporin third generation + aminoglycosides	1	0,8%
Dosage regimen			
Cefazolin 3x300 mg Intravena	First generation cephalosporin	2	1,5%

Cefazolin 3x500 mg Intravena	First generation cephalosporin	10	7,5%
Cefazolin 3x2 gr Intravena	First generation cephalosporin	2	1,5%
Cefazolin 3x1 g Intravena	First generation cephalosporin	65	48,9%
Ceftriaxon 2x1 g Intravena	Third generation cephalosporin	6	4,5%
Ceftazidime 2x1 g Intravena	third generation cephalosporin	2	1,5%
Cefazolin 3x2 g Intravena + Gentamisin 2x40 mg Intravena	First generation cephalosporin + aminoglycoside	19	14,3%
Cefazolin 3x1 g Intravena + Gentamisin 2x40 mg Intravena	First generation cephalosporin + aminoglycoside	25	18,8%
Ceftriaxon 2x1 g intravena + Gentamycin 2x40 mg intravena + Metronidazol 3x500 mg Intravena	Cephalosporin third generation + aminoglycosides + nitroimidazole	1	0,8%
Ceftriaxon 2x1 g intravena + Gentamycin 2x40 mg Intravena	Cephalosporin third generation + aminoglycosides	1	0,8%

Cefazolin was most often used as a postoperative antibiotic in this study (table 3) because it is effective against gram-positive and gram-negative microorganisms (sharoon, 2007). The dose used for adult patients is 0.5–1 g every 6–12 hours. Meanwhile, the dose is 25-50 mg/kg for children in 3-4 divided doses. The dose should be reduced if the patient has creatinine-based renal insufficiency clearance. (Sharon, 2007)

Cefazolin is a time-dependent antibiotic, so the concentration must be constant to work optimally. So, giving 2-3 doses daily is more effective than a single dose (Petri, 2006). If confident there is no growth, prophylactic antibiotics should be discontinued within 24 hours. However, if there is still doubt about bacterial growth, antibiotics can be given within 24-48 hours after surgery. There is still controversy regarding the duration of therapy up to 48 hours after surgery after surgery and its effect on the length of hospital stay.10, (Merrer, 2007)

Ceftazidime and ceftriaxone are third-generation cephalosporins, which were also used as postoperative antibiotics in this study (table 3). Several studies have shown that first-generation cephalosporins such as cefazolin are as effective as third-generation cephalosporins in preoperative and postoperative prophylaxis in orthopedic surgery patients (Anderson, 2002). Some experts state that third-generation cephalosporins are not recommended for use as prophylaxis because they are more expensive. Third-generation cephalosporins also have a broader spectrum of action than required, so their use for prophylaxis can lead to the development of resistant organisms. (McEvoy, 2002)

The working spectrum of ceftazidime and ceftriaxone is broader than cefazolin, so the spectrum of cefazolin is already covered by ceftazidime and ceftriaxone.35 with similar effectiveness, too frequent use will have long-term negative impacts, namely an accelerated increase in microbial resistance to cephalosporin antibiotics.

Gentamicin in this study (table 3) was also widely used in combination form. Gentamicin is an aminoglycoside antibiotic that has the ability to fight Gram-negative and Gram-positive bacteria, including *Staphylococcus aureus*. Gentamicin is often combined with cephalosporins as post-orthopedic prophylaxis in elective surgery and quickly. Using gentamicin as a prophylactic antibiotic aims to prevent the increased prevalence of *Methicillin-resistant Staphylococcus aureus* (MRSA). In a study of patients undergoing surgery hemiarthroplasty for hip fractures, gentamicin contributed to a statistically significant reduction in infections, including infections *Methicillin-resistant Staphylococcus aureus* (MRSA). (Johnson, 2012)

Metronidazole is the least antibiotic used in this study (table 3), namely 0.8%. Metronidazole is a nitroimidazole class antibiotic with a spectrum of activity that includes several protozoa, Gram-positive bacteria, and anaerobic Gram-negative bacteria (Anderson, 2002). Cephalosporins and metronidazole are given in combination because they have synergistic properties as bactericides. Cephalosporin antibiotics work by inhibiting the final stage of peptidoglycan formation. As a result, bacteria will experience autolysis due to enzyme mechanisms in the cell wall when cell wall formation is inhibited (Brunton, 2006). Metronidazole interacts with bacterial cell DNA after the diffusion process into the bacterial cell wall so that the DNA loses its helix structure, and then DNA strand damage occurs. Cell death occurs when bacteria cannot carry out the protein synthesis process. The combination of cephalosporin and metronidazole is only used for prophylaxis and treatment of preoperative or post-surgical infections indicated by infections from Gram-negative enteric bacilli, anaerobic bacteria, and alsoEnterococcus sp. (Simon, 2018)

Cephalosporins are the antibiotics most commonly used orally (table 4). In this study, oral cefadroxil was used in 119 people (89%), followed by cefixime, which was used in 14 people (11%). Cefadroxil is one of the cephalosporin class antibiotics that can be given orally. Cefadroxil can be well absorbed when administered orally through the gastrointestinal tract. Thus, giving cefadroxil as an oral prophylactic drug is a rational action. (Petri, 2006), (Goodman, 2012)

Cefadroxil has broad-spectrum bactericidal properties, which are active against gram-positive and gram-negative bacteria (Petri, 2006), (Goodman, 2012). Cefadroxil is effective against bacteria aerobic gram-positive: S. aureus, which is the most abundant bacteria on the skin, β1-hemolytic streptococci, and bacteria gram-negative aerobes: E *E.coli*, *P.mirabilis*, *Klebsiella* species, *Moraxella catarrhalis*. Cefadroxil is given in a single dose of 1 g per day or divided doses of 2 x 500 mg. Meanwhile, for children, the dose is 30 mg/kg in a single or 2 divided doses and is usually used for five days of treatment (Sharon, 2007; Mistry, 2013). (Sharon, 2007), (Mistry, 2013)

Cefixime was the second choice of antibiotic for oral use after surgery in this study (table 4). Cefixime is a third-generation cephalosporin belonging to the beta-lactamase group, effectively killing a spectrum of bacteria with the most extended half-life. Cefixime is widely used in many countries because it has broad-spectrum activity against all Gram-positive and harmful pathogenic bacteria and atypical organisms, such as mycoplasma and chlamydia.42,43 However, third-generation cephalosporins are limited in their use due to their potential as antibiotics that have a broader spectrum than required, so they are not recommended for use in prophylaxis because they can trigger the development of resistant organisms. (McEvoy, 2008), (Ramdhani, 2021).

Table 4. Types of oral postoperative antibiotics

Medicine name	Group	Number of patients (n)	Percentage (%)
cefadroxil (oral)	First generation cephalosporin	119	89%
Cefixime (oral)	third generation cephalosporin	14	11%
Dosage regimen			
cefadroxil 2x250 mg oral	First generation cephalosporin	8	6,0%
cefadroxil 2x500 mg oral	First generation cephalosporin	111	83,5%
cefixime 2x200mg oral	third generation cephalosporin	14	10,5%

4. Conclusion

The use of preoperative and post-operative antibiotics in orthopedic surgery inpatients in August – December 2023 is by research and recommendations from guidelines. The most widely used antibiotics are *cephalosporins* because their mechanism of action has a broad spectrum against bacteria. Cefazolin, the first generation, is more often used as preoperative and post-operative prophylaxis. Third-generation *cephalosporins* are not widely recommended as prophylaxis because they have the potential to cause antibiotic resistance and are more focused on as therapeutic antibiotics.

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