INDOGENIUS

ISSN 2828-1365

Volume 5, Issue 1 : 7-12

Antibiotic Sensitivity Profile of Bacteria in Open Wound Infections in Orthopedic Patients at Kraton Regional General Hospital, Pekalongan Regency, February 2025

Aditya Firmasnyah[1], Mulia Susanti[1]
[1]*Akademi Analis Kesehatan Pekalongan, Indonesia*

Article Info

Keywords :
Bacteria, Orthopedic Wound Infections, Antibiotic Sensitivity

Corresponding Author :
Aditya Firmansyah
E-mail : firmansadit6@gmail.com

ABSTRACT

Background & Objective: Open wound infections in orthopedic patients are infections caused by accidental wounds that have been contaminated with bacteria. Bacteria enter through abrasions or grazes caused by skin rubbing against rough surfaces such as asphalt. Based on medical records from Kraton Regional General Hospital in Pekalongan Regency in 2024, there were a total of 967 cases of patients due to accidents, and in February 2025, there were 5 patients. This study aims to determine the bacterial species and antibiotic sensitivity of bacterial isolates found in open wound infections in orthopedic patients at Kraton Regional General Hospital in Pekalongan Regency. **Method:** This study used a descriptive research method to identify bacteria and test the antibiotic sensitivity of bacteria in open wound infections in orthopedic patients at Kraton Regional General Hospital, Pekalongan Regency. **Result:** The results of the study showed that 40% of Escherichia coli and 40% of Staphylococcus aureus were found. Escherichia coli from sample one was resistant to Ampicillin and Ceftriaxone and intermediate to Cefotaxime. Escherichia coli from sample four was sensitive to Ampicillin, Ceftriaxone, and Cefotaxime. Staphylococcus aureus from samples three and four was resistant to Ampicillin and Ceftriaxone and sensitive to Cefotaxime. **Conclusion:** There are bacteria causing open wound infections in orthopedic patients at Kraton Regional General Hospital, Pekalongan Regency, namely Escherichia coli 40% and Staphylococcus aureus 40%. The percentage of antibiotic sensitivity tests was Ampicillin 50%, Ceftriaxone 50%, and Cefotaxime 50%.

DOI: https://doi.org/10.56359/igj.v5i1.667

Introduction

Orthopedics is one of various fields of health science that focuses on the maintenance of the joint, bone, muscle, ligament, nerve, and connective tissue systems. There are many causes of orthopedic cases, such as accidents that can cause bone fractures and ligament tears. Environmental factors and unhealthy lifestyles can also contribute to an increase in orthopedic cases, such as obesity, which can increase stress on the joints, and lack of physical activity, which can cause a decrease in muscle and bone strength. (Kuncoro, 2022).

Open wound infections can occur in orthopedic cases when soft tissue is torn or damaged. (Ns. Yance Komela Sari, S.Kep et al., 2024) One example is in accident cases. A wound infection is a condition where the skin is torn or damaged, exposing the underlying tissue to microorganisms such as bacteria or germs. (Anjarwati et al., 2022).

According to World Health Organization (WHO) data from 2023, more than 1.19 million people worldwide died as a result of accidents, and another 20 million to 50 million suffered minor injuries to disabilities. (WHO, 2023) According to the Central Statistics Agency (BPS) in 2022, there were 139,258 accident cases in Indonesia with 28,131 fatalities, 13,364 people suffering severe injuries, and 160,449 people suffering minor injuries. (Statistics, 2024).

Previous research conducted by Senduk RA, Lengkong A, and Sumaryo H on antimicrobial resistance in open fracture infections at Prof. Dr. R. D. Kandou Manado Hospital found that the types of bacteria infecting orthopedic wounds were Staphylococcus aureus and Enterobacter, which accounted for 30% of the findings, with antibiotic resistance dominated by Ampicillin Sulbactam, Ciprofloxacin, and Gentamicin. (Senduk et al., 2024).

Data collection conducted at Kraton District General Hospital in Pekalongan showed that the prevalence of accident cases in 2024 from January to August totaled 967 cases, consisting of 676 outpatients and 291 inpatients. There were 5 cases in February 2025. (Medical Records. Kraton Pekalongan Regional General Hospital 2024). Based on this background, the researcher was interested in conducting a study entitled "Antibiotic Sensitivity Profile in Open Wound Infections in Orthopedic Patients at Kraton Regional General Hospital, Pekalongan Regency, February 2025".

Objective

The purpose of this study was to determine the bacterial species and antibiotic sensitivity profile of bacterial isolates found in open wound infections in orthopedic patients at Kraton Regional General Hospital in Pekalongan Regency.

Method

This study used descriptive research. The population in this study were patients with open wound infections in the orthopedic ward at Kraton Regional General Hospital in Pekalongan Regency. Sampling was conducted using total sampling techniques with a total of 5 samples. The samples were taken from outpatients and inpatients at Kraton Regional General Hospital in Pekalongan Regency. This study was conducted from February 1, 2025, to February 28, 2025. The sample testing was carried out at the Microbiology Laboratory, AAK Peklongan Campus. The data from

the research results were grouped and calculated using the following percentage formula:

Percentage of bacterial findings: $\frac{\text{Type of Bacteria}}{\text{Total samples}} \times 100\%$

Percentage of sensitivity: $\frac{\text{Number of Sensitive Cultures}}{\text{Number of Cultures Tested}} \times 100\%$

Results

Based on the results of bacterial identification tests from 5 samples of open wound infections in orthopedic patients, the following results were obtained:

TABLE 1. Results of Gram-Negative Bacterial Identification

Biochemical Test	Sample A	Sample D
Glucose	+(Gas+)	+(Gas+)
Lactose	+	+
Sucrose	+	+
Maltose	+	+
Mannose	+	+
Indole	+	+
Methyl Red	+	+
Voges-Proskauer	-	-
Citrate	-	-
TSIA	K/A	K/A
Urea	-	-
LIA	V/V	V/V
Bacterial Species	***Escherichia coli***	***Escherichia coli***

Description:
(+) : Positive
(-) : Negative
TSIA : Triple Sugar Iron Agar
LIA : Lysine Iron Agar

TABLE 2. Results of Gram-Positive Bacterial Identification Findings

Sample	Mannitol Test	Catalase Test	Coagulase Test	Bacterial Species
C	FM	+	+	*Staphylococcus aureus*
E	FM	+	+	*Staphylococcus aureus*

Description:
FM : Lactose Fermenter
+ : Positive

TABLE 3. Results of Bacterial Identification in Open Wound Infections in Orthopedic Patients

Sample	Bacterial Species
A, D	*Escherichia coli*
C, E	*Staphylococcus aureus*

TABLE 4. Percentage of Bacterial Findings

Spesies	Percentage
Escherichia coli	40%
Staphylococcus aureus	40%

TABLE 5. Results of Antibiotic Disk Inhibition Zone Diameters

Sample	Bacteria Type	Antibiotic	Inhibition Zone Diameter (mm)	Description
A	*Escherichia coli*	Ampicillin	12	Resistant
		Ceftriaxone	18	Resistant
		Cefotaxime	23	Intermediate
C	*Staphylococcus aureus*	Ampicillin	25	Resistant
		Ceftriaxone	18	Resistant
		Cefotaxime	32	Sensitive
D	*Escherichia coli*	Ampicillin	33	Sensitive
		Ceftriaxone	38	Sensitive
		Cefotaxime	42	Sensitive
E	*Staphylococcus aureus*	Ampicillin	12	Resistant
		Ceftriaxone	18	Resistant
		Cefotaxime	23	Sensitive

TABLE 6. Antibiotic Sensitivity Percentage

Spesies	Percentage
Ampicillin	50%
Ceftriaxone	50%
Cefotaxime	50%

Discussion

The condition of wounds caused by accidents greatly influences the species of bacteria that inhabit the wound. This study found Escherichia coli and Staphylococcus aureus in open wound infections in orthopedic patients at Kraton Regional General Hospital in Pekalongan Regency. The presence of Escherichia coli in open wounds is a factor of contamination from the external environment. The location of the accident, such as a highway near a ditch, contaminated soil and air, are the main factors that allow these bacteria to enter the wound area and cause infection, considering that Escherichia coli is a coliform bacterium commonly found in the digestive tract of humans and animals, soil, water, and air (Bria et al., 2022).

Staphylococcus aureus in open wound infections is a very common condition because Staphylococcus aureus bacteria are a component of normal human skin flora. Torn tissue at the site of the wound allows bacteria to enter and infect, as Staphylococcus aureus can produce toxins and enzymes such as alpha toxin (which destroys erythrocytes and tissue), beta toxin (increases tissue damage), leukocidin toxin (damages erythrocytes and disrupts the body's ability to fight infection), hyaluronidase enzyme (breaks down hyaluronic acid and facilitates the spread of bacteria), and protease enzyme (damages proteins and inhibits cell regeneration). (Tracey A. Taylor, 2023) Nosocomial infections also allow contamination of orthopedic wounds due to unsterilized medical equipment during treatment or medication in hospitals. (Diantoro & Rizal, 2021)

Based on the sensitivity test conducted, the sensitivity results of Escherichia coli bacteria in sample A with Ampicillin and Ceftriaxone antibiotics were resistant, but with Cefotaxime antibiotics, the results were intermediate, while Escherichia coli bacteria in sample D were sensitive to all three antibiotics (Ampicillin, Ceftriaxone, Cefotaxime). The results of the sensitivity test for Staphylococcus aureus bacteria in samples C and E were similar, namely resistant to the antibiotics Ampicillin and

Ceftriaxone and sensitive to the antibiotic Cefotaxime. The emergence of resistance in the same bacterial species is influenced by poor individual health, lack of supervision of wound hygiene, environmental contamination, and genetic mutations. Each species has a variety of genetics that can affect its response to antibiotics. Genetic changes or specific genetics can provide immunity to antibiotics. Each bacterial species has its own mechanism for counteracting the toxic effects of antibiotics, such as producing enzymes to destroy antibiotics, changing the target of antibiotics, or even removing antibiotics from the cell. Other factors such as temperature, pH, and environment can interfere with the effectiveness of antibiotics against bacteria (Paulitsch-Fuchs et al., 2023).

The results of antibiotics Ampicillin, Ceftriaxone, and Cefotaxime being sensitive to Escherichia coli and Staphylococcus aureus are likely due to the normal bacterial cell wall structure, which does not have an active immune system, the absence of β-lactamase enzymes that can destroy antibiotics, and environmental conditions that support the healing process. The condition of patients who have not undergone treatment may be the reason why Escherichia coli and Staphylococcus aureus species are sensitive to ampicillin, ceftriaxone, and cefotaxime antibiotics.

The antibiotic sensitivity results for Ampicillin and Ceftriaxone, which are resistant to Escherichia coli and Staphylococcus aureus, are due to the ability of Escherichia coli and Staphylococcus aureus to produce β-lactamase enzymes that can destroy the toxicity of Ampicillin and Ceftriaxone. However, Staphylococcus aureus that has undergone MRSA (Methicillin-resistant Staphylococcus aureus) against other beta-lactam antibiotics tends to be more difficult to treat and has a higher risk of infection (Ali Alghamdi et al., 2023). This problem poses a major obstacle in the cure or treatment of bacterial infections.

The percentage of Escherichia coli and Staphylococcus aureus bacteria found was 40% each. The antibiotic sensitivity test percentage of 50% indicates that each of the antibiotics (Ampicillin, Cefotaxime, Ceftriaxone) has the same level of effectiveness or success in treating or curing certain infections. In this study, the 40% bacterial detection rate and 50% sensitivity rate indicate that half of the Escherichia coli and Staphylococcus aureus infections treated with these antibiotics were successfully cured, in line with previous research conducted by Senduk RA, Lengkong A, Sumaryo H, related to antimicrobial resistance in open fracture infections at Prof. Dr. R. D. Kandou General Hospital in Manado. The study found that the types of bacteria infecting orthopedic wounds were Staphylococcus aureus and Enterobacter, with a detection rate of 30% and antibiotic resistance dominated by Ampicillin Sulbactam, Ciprofloxacin, and Gentamicin. (Senduk et al., 2024)

Conclusion

Escherichia coli and Staphylococcus aureus bacteria were found in open wound infections in orthopedic patients at Kraton Regional General Hospital in Pekalongan Regency in February 2025, with antibiotic sensitivity rates for Ampicillin, Ceftriaxone, and Cefotaxime at 50% each.

Recommendations for future researchers include using a wider variety of antibiotics.

References

Ali Alghamdi, B., Al-Johani, I., Al-Shamrani, J. M., Musamed Alshamrani, H., Al-Otaibi, B. G., Almazmomi, K., & Yusnoraini Yusof, N. (2023). Antimicrobial resistance in methicillin-resistant staphylococcus aureus. Saudi Journal of Biological Sciences, 30(4), 103604. https://doi.org/10.1016/j.sjbs.2023.103604

Anjarwati, A., Jannah, A. H., Ramadani, G. K. D., Masruro, Rahmatillah, K., & Romla, S. (2022). Pengenalan Luka Dan Macam-Macam Luka Dalam Kegiatan Tri Bakti PMR Di SDN Sukabumi I. Jurnal Pendidikan, Sains Dan Teknologi, 1(3), 270–275. https://doi.org/10.47233/jpst.v1i2.362

Bria, D. I., Missa, H., & Sombo, I. T. (2022). Isolasi Dan Karakterisasi Bakteri Escherichia coli Pada Bahan Pangan Berbasis Daging Di Kota Kupang PENDAHULUAN Berdasarkan Undang-Undang Republik Indonesia Nomor 7 Tahun 1996 tentang Pangan dan Peraturan Pemerintah Republik Indonesia Nomor 28 Tahun 2004. Jurnal Sains Dan Terapan, 1(2), 82–89.

Diantoro, M. S., & Rizal, A. A. F. (2021). Tradisional Literature Review : Kepatuhan Mencuci Tangan Perawat dengan Kejadian Infeksi Nosokomial. Borneo Student Reserch, 2(3), 2721–5725.

Kuncoro, dr. J. (2022). Buku Ajar Blok Muskoloskeletal - Aspek Ortopedi. Airlangga University Press. https://books.google.co.id/books?id=MBVZEAAAQBAJ&lpg=PP1&ots=2ANWpXnwYY&dq=definisi orthopedi&lr&hl=id&pg=PP1#v=onepage&q=definisi orthopedi&f=false

Ns. Yance Komela Sari, S.Kep., M.Kep, Ns. Nopan Saputra, S.Tr. Kes., S.Kep., M. K. (2024). Perawatan Luka. https://books.google.co.id/books?id=8rkgEQAAQBAJ&printsec=frontcover&hl=id#v=onepage&q&f=false

Paulitsch-Fuchs, A. H., Melchior, N., Haitzmann, T., Fingerhut, T., Feierl, G., Baumert, R., Kittinger, C., & Zarfel, G. (2023). Analysis of Extended Spectrum Beta Lactamase (ESBL) Genes of Non-Invasive ESBL Enterobacterales in Southeast Austria in 2017. Antibiotics, 12(1), 1–10. https://doi.org/10.3390/antibiotics12010001

RSUD Kraton Pekalongan. (2024). Data rekam medis tahun 2024.

Senduk, R. A., Lengkong, A., & Sumaryo, H. (2024). Pola Bakteri dan Resistensi Antimikroba pada Infeksi Terkait Fraktur. 12(2), 220–226.

Statistik, B. pusat. (2024). Jumlah Kecelakaan, Korban Mati, Luka Berat, Luka Ringan, dan Kerugian Materi, 2022. Badan Pusat Statistik. https://www.bps.go.id/id/statistics-table/2/NTEzIzI=/jumlah-kecelakaan-korban-mati-luka-berat-luka-ringan-dan-kerugian-materi.html

Sukertiasih, N. K., Megawati, F., Meriyani, H., & Sanjaya, D. A. (2021). Studi Retrospektif Gambaran Resistensi Bakteri terhadap Antibiotik. Jurnal Ilmiah Medicamento, 7(2), 108–111. https://doi.org/10.36733/medicamento.v7i2.2177

Tracey A. Taylor, C. G. U. (2023). Staphylococcus aureus Infection. National LLbrary of Medicine. https://www.ncbi.nlm.nih.gov/books/NBK441868/#article-29453.s1