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Sensitivity Test Of *Methicillin-Resistant Staphylococcus Aureus* Bacteries To Antibiotics

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ABSTRACT

Methicillin-resistant Staphylococcus aureus, an infectious disease caused by the Staphylococcus aureus bacteria, which has developed resistance to antibiotics. The spread of this infection is a new challenge for medical professionals due to the increased risk of morbidity and mortality that occurs. The study aimed to evaluate the sensitivity of Methicillin-resistant Staphylococcus aureus (MRSA) to various antibiotics, including gentamicin, ciprofloxacin, cefixime, vancomycin, and chloramphenicol. This descriptive research involved laboratory testing to determine antibiotic effectiveness.The results of laboratory tests showed that *Methicillin-resistant Staphylococcus aureus bacteria exhibited sensitivity to ciprofloxacin antibiotics, showing an inhibition zone of 23.8 mm at a 5 mcg dose*, Gentamicin antibiotics demonstrated an inhibition zone of 21.3 mm at a concentration of 10 mcg, while vancomycin antibiotics showed an inhibition zone of 18.5 mm at a concentration of 30 mcg. Methicillin-resistant Staphylococcus aureus (MRSA) was resistant to cefixime antibiotics at a concentration of 5 mcg and chloramphenicol antibiotics at a concentration of 30 mcg, showing an inhibition zone of 0 mm for both. Ciprofloxacin, gentamicin, and vancomycin antibiotics are suitable for use as antibiotics to treat Methicillin-resistant Staphylococus aureus infections, while chloramphenicol antibiotics and cefixme antibiotics are not suitable for use. Inappropriate use of antibiotics causes bacterial resistance to antibiotics and can be very fatal, therefore the use of antibiotics needs to be done wisely and rationally based on doctor's recommendations.

Keywords: Antibiotics, Methicillin Resistant *Staphylococcus aureus*.

Introduction

Methicillin-resistant Staphylococcus aureus, an infectious disease caused by *Staphylococcus aureus* bacteria that develop immunity to antibiotics. The spread of this infection is a new challenge for medical professionals due to the increased risk of morbidity and mortality that occurs. *Staphylococcus aureus* bacteria are one of the normal flora bacteria that live on the skin, mucous membranes and mucosa, sometimes these bacteria can turn into pathogenic bacteria because they can be influenced by a variety of factors, namely host characteristics, food, and the use of antibiotics given. (Srimurtini, Mastra, & Sofi Yanty, 2020)

The very high prevalence rate of *Methicillin-resistant Staphylococcus aureus* infections in Asian countries varies widely from 5% to 35% and Indonesia's 28% influences the increase in morbidity and mortality rates every year (Suyasa, 2020) . Community populations consisting of individuals who have not undergone any medical procedure or hospitalization in the past year may be susceptible to *Methicillin-resistant Staphylococcus aureus* infection. Community-associated Methicillin- resistant *Staphylococcus aureus* (CA-MRSA) (Prasetio & Barliana, 2016) . A person's lifestyle or behavior, including smoking, can contribute to the development of CA-MRSA, as acute and chronic sinusitis infections have a higher incidence of *Methicillin-resistant Staphylococcus aureus* infection than those who do not smoke (Bintari & Parwati, 2020)

Treatment for *Staphylococcus aureus* infections generally uses antibiotics that can inhibit the growth or kill the bacteria. This activity leads to the emergence of antibiotic-resistant strains of bacteria that complicate the treatment process so that the infection continues to spread. *Methicillin-resistant Staphylococcus aureus* is a *Staphylococcus aureus* bacterium that is immune to isoxazoyl penicillin antibiotics such as methicillin, oxacillin and flucloxacillin (Suyasa, 2020).

Resistance to antibiotics such as *Methicillin-resistant Staphylococcus aureus* alone accounts for nearly half of all deaths caused by antibiotic-resistant organisms (Fukugana, Sumida, Taira, Davis, & Seto, 2016) . Antibiotic resistance in bacteria is a consequence of inappropriate use. Intolerance to MRSA (*Methicillin-resistant Staphylococcus aureus*) which has undergone genetic modification is *Staphylococcus aureus*. This super bacteria got its name from its resistance to various beta-lactam and penicillin antibiotics, including methicillin, oxacillin, and cephalosporins. *Methicillin-resistant Staphylococcus aureus* shows similar microscopic characteristics, including biochemistry and colony formation. The only difference between these bacteria is that they have resistance to several classes of antibiotics and develop at a relatively slow rate on certain media (Pristianingrum, Zainiati, Muttaqin, Puspita, & Arman, 2021).

Based on the above background, the authors are interested in conducting a study entitled Sensitivity Test of *Methicillin-resistant Staphylococcus aureus* Bactei Against Antibiotics.

Research Method

This type of research is descriptive research with laboratory examination, aims to determine the sensitivity of *Methicillin-resistant Staphylococcus aureus* with various types of anitbiotics such as gentamicin antibiotics, ciprofloxacin antibiotics, cefixime antibiotics, vancomycin antibiotics and chloramphenicol antibiotics. A total of 20 samples were obtained from 2 Petri dishes of MRSA isolates and 5 types of antibiotics and were repeated 2 times. This research was conducted UPTD. Balai Laboratorium Kesehatan Kerthi Bali Sadhajiwa Bali Province in May 2024. The examination method is agar plate diffusion method to confirm the sensitivity of Methicillin Resistant *Staphylococcus aureus* to antibiotics, through inoculation of *Methicillin-resistant Staphylococcus aureus* bacterial culture on Muller Hinton Agar media. After that, incubation was carried out in an incubator at 35 ° C ± 1 ° C for 18 ± 2 hours. The results of the sensitivity test were then measured using a caliper. The measurement results were matched with the European Committee on Antimicronial Susceptibility Testing (EUCAST) standard, namely sensitive (S) > 17 mm and resistant (R) ≤17 mm.

Results and Discussions

The results of the Sensitivity Test measuring the inhibition zone on 20 samples of Muller Hinton Agar Media with *Methicillin-resistant Staphylococcus aureus* bacteria are listed in table 1.

Table 1 Research Results

		Diameter of Inhibition Zone			
Bacterial parent	**Anitbiotics**	**Repeat1**	**Repeat2**	**Average**	**Description**
Methicillin-resistant Staphylococcus aureus (1)	Gentamicin	21,3mm	21,4mm	21,3 mm	Sensitive
	Ciprofloxacin	23,8mm	23,9mm	23,8 mm	Sensitive
	Vancomycin	18,7 mm	18,3 mm	18,5 mm	Sensitive
	Cefixme	0 mm	0 mm	0 mm	Resisten
	Chloramphenicol	0 mm	0 mm	0 mm	Resisten
Methicillin-	Gentamicin	21,3m	21,4m	21,3	Sensitive

resistant Staphylococcus aureus (2)		m	m	mm	
	Ciprofloxacin	23,8m m	23,9m m	23,8 mm	Sensitive
	Vancomycin	18,7 mm	18,3 mm	18,5 mm	Sensitive
	Cefixme	0 mm	0 mm	0 mm	Resisten
	Chloramphenicol	0 mm	0 mm	0 mm	Resisten

Based on the table above, the results of 20 samples that have been inoculated with *Methicillin-resistant Staphylococcus aureus* bacteria with gentamicin, ciprofloxacin, cefixime, vancomycin and chloramphenico antibiotics are as follows:

1. *Methicillin-resistant Staphylococcus aureus* bacteria sensitive to Ciprofloxacin antibiotic characterized by inhibition zone size greater than the European Committee on Antimicronial Susceptibility Testing (EUCAST) standard which is for sensitive > 17 mm.
2. *Methicillin-resistant Staphylococcus aureus* bacteria are sensitive to Gentamicin antibiotics which are characterized by inhibition zone sizes greater than the European Committee on Antimicronial Susceptibility Testing (EUCAST) standard, which is for sensitive > 17 mm.
3. *Methicillin-resistant Staphylococcus aureus* bacteria are sensitive to the antibiotic vancomycin which is characterized by an inhibition zone size greater than the European Committee on Antimicronial Susceptibility Testing (EUCAST) standard, which is for sensitive > 17 mm.
4. *Methicillin-resistant Staphylococcus aureus* bacteria are not sensitive or resistant to the antibiotic Chloramphenicol which is characterized by a smaller inhibition zone size than the European Committee on Antimicronial Susceptibility Testing (EUCAST) standard, which is for sensitive < 17 mm.
5. *Methicillin-resistant Staphylococcus aureus* bacteria are not sensitive or resistant to the antibiotic Cefixme which is characterized by an inhibition zone size smaller than the European Committee on Antimicronial Susceptibility Testing (EUCAST) standard for

sensitive < 17 mm.

Based on table 1 of the research results, it shows that ciprofloxacin antibiotics gentamicin antibiotics, and vancomycin antibiotics are feasible to use as antibiotics to treat infections caused by Methicillin-resistant Staphylococus aureus. While in Methicillin- resistant Staphylococus aureus to chloramphenicol antibiotics and cefixme antibiotics are not feasible to use as antibiotics to treat infections caused by Methicillin-resistant Staphylococus aureus.

Inappropriate use of antibiotics and the low level of public knowledge regarding the use of antibiotics cause bacterial resistance to antibiotics (Nufus & Pertiwi, 2019) . Bacterial resistance to these antibiotics can be very fatal, infectious diseases caused by treatment-resistant bacteria increase a person's illness and hospitalization. When treatment is slow or even fails, the patient can become a bacterial host (carrier). This is what makes antibiotic resistance possible in many people. Therefore, it is necessary to use antibiotics rationally, which is based on recommendations to prevent antibiotic resistance to bacteria. The use of antibiotics is very necessary to be done wisely so that the rate of recovery increases rapidly and reduces the length of hospitalization, financing, transmission to others, the number of sick, and of course prevents resistance (Dinkes Kalimantan Barat, 2020).

Antibiotics inhibit the growth zone of *Methicillin-resistant Staphylococcus aureus* in this case the antibiotics chosen are gentamicin antibiotics, ciprofloxacin antibiotics, cefixime antibiotics, vancomycin antibiotics and chloramphenicol antibiotics. Where the mechanism of action is to inhibit protein synthesis and inhibit cell wall synthesis. This research is in line with the research of Oka Suyasa et al, where *Methicillin-resistant Staphylococcus aureus* is resistant to resistant chloramphenicol antibiotics, cefixme and for gentamicin has intermediates. The similarity in this study lies in the *Methicillin-resistant Staphylococcus aureus* bacteria to the same chloramphenicol and cefixme antibiotics that are not sensitive. Meanwhile, Methicillin-resistant Staphylococcus bacteria against gentamicin antibiotics in this study are still sensitive. There are 3 antibiotics that are still sensitive in this study, namely vancomycin, ciprofloxacin and gentamicin (Suyasa, 2020).

The difference in results obtained in other studies is very likely due to the limited number of *Methicillin-resistant Staphylococcus aureus* bacterial sample culture media obtained in this study. In addition, the source of samples is different where this study took ready-made samples or bacterial cultures that had been cultured while other studies came from health workers and patients (Martiyaningsih & Farida, 2012). The characteristics of different antibiotic content affect the inhibition results (Nurani, Soleha, & Ramadhian, 2018).

Conclusion

Methicillin-resistant Staphylococcus aureus (MRSA) bacteria exhibited sensitivity to several antibiotics, including ciprofloxacin, gentamicin, and vancomycin. Specifically, when treated with ciprofloxacin at a dose of 5 mcg, the bacteria showed an inhibition zone of 23.8 mm, indicating strong antibacterial activity. Gentamicin, at a concentration of 10 mcg, produced an inhibition zone of 21.3 mm, while vancomycin, at a concentration of 30 mcg, resulted in an inhibition zone of 18.5 mm, demonstrating their effectiveness against MRSA. MRSA bacteria were found to be resistant to cefixime at a concentration of 5 mcg and chloramphenicol at a concentration of 30 mcg. For both of these antibiotics, no inhibition zone

was observed, with a recorded measurement of 0 mm, indicating that these antibiotics were ineffective in inhibiting the growth of MRSA in this context. This resistance highlights the challenge of treating MRSA infections with certain antibiotics and underscores the need for alternative or combination therapies.

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Conflic of Interest

There is no conflict of interest in this study.

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