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Comparison of the effectiveness of *savlon* antiseptic with povidone-iodine for *acinetobacter baumannii* infected wounds in white rats (*Rattus Norvegicus*)

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***Abstract*---**Wound washing with antiseptic liquid is one step in the management of chronic wounds. In infected wounds, washing with antiseptic is expected to reduce bacterial colonies and help eradicate infection. One of the important pathogenic bacteria is *Acinetobacter Baumannii*. These opportunistic germs can form colonies, especially in patients receiving broad-spectrum antibiotic therapy, treatment in the ICU, and on skin affected by burns. Antiseptic commonly used to wash wound are Savlon and Povidone-iodine 10%. Both antiseptic are broad spectrum antisepctic, kill gram negative and gram positive bacteria. However Savlon could caused skin irritation. Therefore dilution is needed to prevent this effect. This study was intended to determine the difference and comparison of the effectiveness of Savlon and Povidone iodine antiseptic to bacterial growth on wound infected by *Acinetobacter Baumannii.* This study is an experimental study with a randomized controlled trial without blinding. The wound research procedure was made on the right and left sides of the rat's back with a size of 1x1 cm each. Wounds that have been contaminated with *Acinetobacter Baumannii* are left for 4 hours. After 4 hours the wound will be washed and irrigated. The wound that has been made is closed with a transparent dressing. Twelve hours later the sample excised tissue specimens will be collected to see how many bacterial colonies occured. The data from the research before being analyzed were in

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logarithmic transformation. Then normality test was carried out. Because the data were normally distributed, the test was performed with One-Way Anova. The results of the normality test were normally distributed, the sample group was given *Savlon* antiseptic p = 0.000 and the sample group was given 10% povidone-iodine antiseptic. p = 0.035 (p < 0.05). The results of statistical tests showed a significant difference between the sample group given *Savlon* antiseptic and the sample group given 10% povidone-iodine antiseptic. The average number of colonies of *Acinetobacter Baumannii* given Savlon antiseptic was 4.250±1.107 (CFU/mL) and that given 10% povidone-iodine antiseptic was 3.500±1.154 (CFU/mL). p = 0.000 (p < 0.05). Comparison of the effectiveness of *Savlon* antiseptic with povidone-iodine for wounds infected with *Acinetobacter Baumannii* in white rats (*Rattus Norvegicus*) was 0%: 68.75 %.

Keywords---*Savlon* antiseptic, povidone-iodine antiseptic, *Acinetobacter Baumannii*, white rat *(Rattus norvegicus).*

Introduction

The wound is a state of disconnection of tissue continuity caused by various things such as trauma, temperature changes, chemicals, explosions, electric shocks, or animal bites. The shape of the wound varies depending on the cause, there are open and closed. Wound washing with antiseptic liquid is one of the steps in the management of chronic wounds. In infected wounds, washing with antiseptic is expected to reduce bacterial colonies and help eradicate infection. One of the important pathogenic bacteria is *Acinetobacter Baumannii*. These opportunistic germs can form colonies, especially in patients receiving broad-spectrum antibiotic therapy, treatment in the ICU, and on burnt skin (Rossolini & Mantengoli, 2005).

It has long been defined bacteria was a source of infection which is difficult to treat and begins to infect wounds at the end of the first week of injury (Taylor, 1916) and is reported to infect up to a third of burn patients in hospitals (Nagoba, Selkar, Wadher, & Gandhi, 2013). Based on the results of research by Shete et al (2010), it was found that 11.6% of VAP was caused by Acinetobacter bacteria.

The standard antiseptic for wound care in the plastic surgery department is *Savlon* and Povidone-Iodine for intact skin. Savlon is one of the ingredients which has long been used in Europe as a washing fluid for wounds, especially those infected with *Acinetobacter Baumannii*. Reports of the effectiveness of *Savlon* against other types of bacteria found in chronic infected wounds are also widely found. The organic nature of *Savlon* also has the potential to not cause unwanted side effects when applied to wounds. An old study with small samples and clinical trials proved that chlorhexidine gluconate-cetrimide did not affect the rate of epithelialization in wounds (Gruber, Vistnes, & Pardoe, 1975). Until now, *Savlon* is still used as an antiseptic alternative (Nagoba *et al.*, 2013), especially when resistance to various antibiotics occurs (Nagoba, Wadher, Kulkarni, & Kolhe,

2008) and is a promising ingredients as an antiseptic alternative in the future (Halstead *et al.,* 2015).

In this study, the *Savlon* used was a combination of 7.5% chlorhexidine gluconate antiseptic and 15% cetrimide which was diluted 30 times. Povidone-iodine (Betadine) is an antiseptic liquid containing polyvinylpyrrolidone with water, iodide, and 1% iodine. This liquid has a bactericidal ability against pathogenic bacteria. Povidone iodine has bactericidal, fungicidal, tuberculoidal, viralidal and sporisical effects. This material quickly enters microorganisms and attacks key groups of proteins (especially sulfur-containing groups, namely cysteine and methionine), nucleotides, and fatty acids that lead to cell death (McDonnell & Russell, 1999). In 10% Povidone-Iodine contains 1% iodine which can kill bacteria in 1 minute and kill spores in 15 minutes. Povidone-iodine is used to prevent infection in burns and skin abrasions, prophylaxis of surgical infections, and as an antiseptic for hand washing in surgery.

This study aims to determine the difference in the effectiveness of *Savlon* antiseptic with Povidone-Iodine on wounds in white rats (Rattus norvegicus) and to determine the comparison of the effectiveness of *Savlon* antiseptic with Povidone-Iodine, based on the number of colonies of *Acinetobacter Baumannii* bacteria grows on wounds in white rats (Rattus norvegicus).

Method

This study is an experimental study with a randomized controlled trial without blinding. Contamination time is the time it takes for germs to enter a trauma wound that is not sterile, will only be in the wound and wound wall, and has not invaded the wound. network. The time required for bacterial contamination is 6-8 hours. (Mardzoeki, 2018)

Research Procedure Wounds were made on the backs of rats on the right and left sides, each measuring 1x1 cm. Wounds that have been contaminated with *Acinetobacter Baumannii* are left for 4 hours. After 4 hours the wound will be washed and irrigated using the method used in the study of E. Kanno, Tanno, Suzuki, Kamimatsuno, & Tachi (2016). The wound that has been made is closed with a transparent dressing.Twelve hours later the sample tissue will be excised to get tissue specimens to see how many bacterial colonies were formed. *Acinetobacter Baumannii* germs can multiply twice during the first 4 hours (Luisa, et.al; 2013)

Research Variables. Independent variables included *Savlon* antiseptic and 10% povidone-iodine antiseptic. The dependent variable is the growth of the number of colonies of *Acinetobacter Baumannii.* In this study, the subjects studied were wounds infected with *Acinetobacter Baumannii* in white rats. The population “in this study” was white rats (Rattus norvegicus) i.e. wounds infected with *Acinetobacter Baumannii*

The number of samples is the number of groups or the number of samples in one study. The number of samples is the number of specimens or subjects in one sample. Calculation of sample size follows the formula:

Federer [(t-1)(r-1)>15].
Description: t = number of interventions given r = replication

Following this formula, with two treatments (t=2), the required repetitions were more than sixteen (r>15). Given the possibility of death of rats during the experiment, the sample size for each treatment was determined to be 16 (sixteen). Randomly, white rats were grouped into six cages, each with two cages for one type of treatment. To reduce bias, the researcher determined the inclusion and exclusion criteria to determine the research subjects. Inclusion criteria included: male white rat (Rattus norvegicus), weight 250-350 grams, 3-4 months old, and healthy. While the exclusion criteria included: weight loss >10% during the adaptation period in the laboratory and the presence of symptoms of illness (hair loss, exudate from the eyes, inactivity) during the adaptation period in the laboratory.

The collected data was analyzed using SPSS version 21. Statistical test with the One-Sample Kolmogorov-Smirnov test for normality. If normally distributed, it was carried out with the one-way Anova test and continued with post hoc analysis. to both groups (the group was given *Savlon* antiseptic and the group was given 10% povidone-iodine antiseptic).

Results and Discussion

This study was to compare the effectiveness of *Savlon* antiseptic with povidone-iodine for wounds infected with *Acinetobacter Baumannii* in white rats (Rattus norvegicus). The results of the analysis of the growth of *Acinetobacter Baumannii* on wounds of white rats (Rattus norvegicus) given *Savlon* antiseptic and povidone-iodine antiseptic were shown in Table 1.

Table 1
Growth of *Acinetobacter Baumannii* for Wounds in White Rats (Rattus norvegicus) was given Savlon antiseptic and Povidone-Iodine Antiseptic

Sample Number	The growth of *Acinetobacter Baumannii* bacteria is given an antiseptic Savlon		The growth of *Acinetobacter Baumannii* bacteria is given the antiseptic Povidon Iodine	
	Pre	Post	Pre	Post
1	+	+	+	+
2	+	+	+	+
3	+	+	+	+
4	+	+	+	+
5	+	+	+	+
6	+	+	+	+
7	+	+	+	+
8	+	+	+	+
9	+	+	+	+
10	+	+	+	+
11	+	+	+	+
12	+	+	+	+

Sample Number	The growth of *Acinetobacter Baumannii* bacteria is given an antiseptic Savlon		The growth of *Acinetobacter Baumannii* bacteria is given the antiseptic Povidon Iodine	
	Pre	Post	Pre	Post
13	+	+	+	+
14	+	+	+	+
15	+	+	+	+
16	+	+	+	+

In Table 1, the growth of *Acinetobacter Baumannii* in wounds of white rats (Rattus norvegicus) given *Savlon* antiseptic and 10% Povidone-Iodine in pre and post from 16 samples were positive. Or there is growth in all sample groups 100%. (100% vs 100%). The study of Langgartner *et al* (2012) found the growth of bacterial colonies on the epidural catheter was lower in the Chlorhexidine-alcohol group when compared to Povidone-Iodine (4.7% vs 30.8%). Compared to Langgartner's study the growth of *Acinetobacter Baumannii* in this study was the same, but the percentage growth is different. In Langgartner's study, the administration of a disinfectant solution using a combination of Chlorhexidine gluconate cetrimide alcohol 70% had better effectiveness in reducing bacterial colonies when compared to the use of 10% Povidone-Iodine solution, because chlorhexidine gluconate is a strong and broad-spectrum antiseptic solution, effective against almost all bacteria gram-positive and gram-negative and nosocomial fungi. Compounds in chlorhexidine gluconate efficiently alter the permeability of the cell wall and rapidly precipitate components of the cell membrane and cytoplasm. The addition of isopropyl alcohol will further enhance the bactericidal effect. One of the advantages of chlorhexidine is its ability to penetrate the stratum corneum, thereby increasing its duration of action for several hours after use. In general, these ingredients cause milder skin reactions than other ingredients and work effectively even in the presence of organic materials such as blood or other protein ingredients.

The results of the calculation of the number of *Acinetobacter Baumannii* colonies for wounds in white rats (Rattus norvegicus) given the antiseptic Savlon and Povidone-Iodine was shown in Table 2.

Table 2
A number of *Acinetobacter Baumannii* Colonies for wounds. White rats (Rattus norvegicus) were given the antiseptic Savlon and Povidone-Iodine

Sample Number	The number of colonies of *Acinetobacter Baumannii* bacteria was given Savlon antiseptic (CFU/mL)		The number of colonies of *Acinetobacter Baumannii* was given the antiseptic Povidone-Iodine (CFU/mL)	
	Pre	Post	Pre	Post
1	$>10^5$	$>10^5$	$>10^5$	$>10^3$
2	$>10^5$	$>10^5$	$>10^5$	$>10^3$
3	$>10^5$	$>10^5$	$>10^5$	$>10^3$
4	$>10^5$	$>10^5$	$>10^5$	$>10^3$
5	$>10^5$	$>10^5$	$>10^5$	$>10^5$

Sample Number	The number of colonies of *Acinetobacter Baumannii* bacteria was given Savlon antiseptic (CFU/mL)		The number of colonies of *Acinetobacter Baumannii* was given the antiseptic Povidone-Iodine (CFU/mL)	
	Pre	Post	Pre	Post
6	$>10^5$	$>10^5$	$>10^5$	$>10^5$
7	$>10^5$	$>10^5$	$>10^5$	$>10^3$
8	$>10^5$	$>10^5$	$>10^5$	$>10^5$
9	$>10^5$	$>10^5$	$>10^5$	$>10^3$
10	$>10^5$	$>10^5$	$>10^5$	$>10^3$
11	$>10^5$	$>10^5$	$>10^5$	$>10^3$
12	$>10^5$	$>10^5$	$>10^5$	$>10^3$
13	$>10^5$	$>10^5$	$>10^5$	$>10^5$
14	$>10^5$	$>10^5$	$>10^5$	$>10^5$
15	$>10^5$	$>10^5$	$>10^5$	$>10^1$
16	$>10^5$	$>10^5$	$>10^5$	$>10^3$

In Table 2 the number of *Acinetobacter Baumannii* colonies on wounds of white rats (Rattus norvegicus) given *Savlon* antiseptic from the 16 samples at pre and post was $> 10^5$. Based on these data from pre to post there was no reductionin the colony number. Meanwhile, in white rats (Rattus norvegicus) given Povidone-Iodine, there were reduction in number of colonies of *Acinetobacter Baumannii* (CFU/mL), in samples number 1,2,3,4,7,9,10,11,12 and 16 from 10^5 to $>10^3$, in sample number 15 from 10^5 to $>10^1$ and in samples number 5 ,6,8,13 and 14 still $>10^5$. So that, the number of colonies of *Acinetobacter Baumannii* (CFU/mL) given Povidone-Iodine was decrease of about 68,75%. (0% vs 68.75%). or a decrease of 68.75%.
A photo of the number of colonies of *Acinetobacter Baumannii* (CFU/mL) is shown in Figure 2.

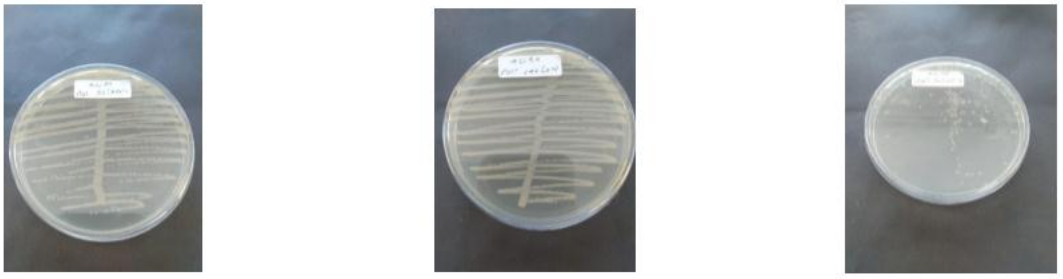

Figure 2. Photo of the number of colonies of *Acinetobacter Baumannii* (CFU/mL)

Statistical Test Results

The data collected was processed in logarithmic transformation. The purpose of this data transformation is to change the measurement scale of the original data into another form so that the data can meet the assumptions that underlie the analysis of variance. Then the normality test was carried out on the data. The

normality test of the data used the One-Sample Kolmogorov-Smirnov Test. If the data is normally distributed, it is tested with One-Way Anova. The results of the normality test are normally distributed as in Table 3

Table 3
Normality Test Results for Sample Group Data

Sample Group	Total Sample	Statistic Test Result
Given an antiseptic Savlon	16	p = 0,000
Antiseptic Povidone-Iodine was given	16	p = 0,035

In Table 3 the data are normally distributed for sample group given *Savlon* antiseptic p = 0.000 and sample group given 10% povidone-iodine antiseptic p-value = 0.035 (p < 0.05), then hypothesis testing was continued using the One Way ANOVA statistical test to determine the comparison of the effectiveness of *Savlon* antiseptic with povidone-iodine for wounds infected with *Acinetobacter Baumannii* in white rats (Rattus norvegicus) based on the average number of colonies of *Acinetobacter Baumannii*. The results of statistical tests with One Way Anova were shown in Table 4.

Table 4
Results of One Way Anova Statistic Test

Sample Group	The average number of colonies of Acinetobacter Baumannii (CFU/mL .)	Total Sample	Statistic Test Result
Given an antiseptic Savlon	4,250±1,107	16	p = 0,000
Antiseptic Povidone-Iodine was given	3,500±1,154	16	

The one-way Anova statistical test in Table 4 showed that there was a significant difference between the sample group given *Savlon* antiseptic and the sample group given 10% Povidone-Iodine antiseptic. The average number of colonies of *Acinetobacter Baumannii* (CFU/mL) given *Savlon* antiseptic was 4.250±1.107 and the average number of colonies of *Acinetobacter Baumannii* (CFU/mL) given 10% Povidone-Iodine antiseptic was 3.500±1.154.(transformated data) with a value of p = 0.000 (p < 0.05). The occurrence of differences in antiseptic effectiveness between the administration of *Savlon* antiseptic and Povidone-Iodine shown that Povidone iodine 10% is more able to reduce the colonization of *Acinetobacter Baumannii*. This is because of the iodine content of the complex Povidone iodine which functions as a bacteriostatic, so that it can inhibit the growth of microorganisms that are in or on the surface of body tissues.

These results are not in accordance with the research results of Khadafi Indrawan *et.al*; (2015), who stated that, the administration of a disinfectant solution using a combination of Chlorexidine gluconate cetrimide alcohol 70% (*Savlon*) there is a difference in effectiveness in reducing bacterial colonies when compared to the use of 10% Povidone-Iodine solution, because chlorhexidine gluconate is a strong and broad-spectrum antiseptic solution, effective against almost all bacteria

(gram positive and gram negative) and nosocomial fungi. Compounds in chlorhexidine gluconate efficiently alter the permeability of the cell wall, and rapidly precipitate components of the cell membrane and cytoplasm. The addition of isopropyl alcohol will further enhance the bactericidal effect. One of the advantages of chlorhexidine is its ability to penetrate the stratum corneum, thereby increasing its duration of action for several hours after use. In general, these ingredients cause some milder skin reactions than other ingredients and work effectively even in the presence of organic materials such as blood or other protein ingredients.

The effectiveness of *Savlon* in reducing the number of bacterial colonies of *Acinetobacter Baumannii* is lower than that of Povidone-Iodine. This is because, in this study Graphically, the comparison of the effectiveness of *Savlon* antiseptic with Povidone-Iodine for *Acinetobacter Baumannii* infected wounds in white rats (*Rattus Norvegicus*) in this study is shown in Figure 3.

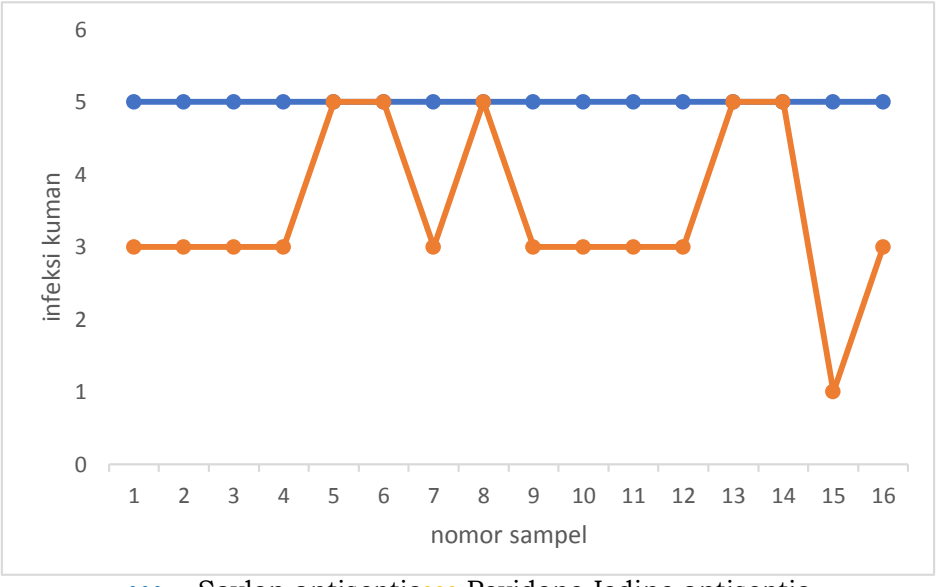

Figure 3. Comparison of the Effectiveness of Savlon Antiseptic with Povidone-Iodine for *Acinetobacter Baumannii* Infected Wounds in White Rats (*Rattus Norvegicus*)

Figure 3 shows the comparison between the effectiveness of *Savlon* antiseptic from 16 samples, the graph is horizontal or there is no decrease in the number of colonies of *Acinetobacter Baumannii* given *Savlon* antiseptic (CFU/mL) (0%) and the effectiveness of Povidone-Iodine antiseptic from 16 samples, the graph goes up, flat and down. or an increase in the effectiveness of the antiseptic Povidone-Iodine (CFU/mL) of about 68.75 %.

The lower decrease in the number of colonies of bacteria *Acinetobacter Baumannii* given *Savlon* antiseptic, because in this study the Savlon disinfectant was diluted for 30 times. The dilution method is one of the methods of testing disinfectants

that are generally used in laboratories. In this method, the strength of the disinfectant is expressed by the coefficient of phenol.

The value of the phenol coefficient itself is to compare the quotient of the highest dilution factor of the disinfectant with the highest dilution factor of standard phenol, each of which can kill bacteria. The activity test of a phenol solution through dilution of the active substance solution is expressed as a number and calculated by means of a period of 10 minutes, but does not kill within 5 minutes (Waluyo, 2008) The phenol coefficient of less than 1 indicates that the antibacterial agent is less effective. On the other hand, if the phenol coefficient is more than 1, the antibacterial agent is more effective than phenol (Campbell, 2010). With the formula of the phenol coefficient in the administration of *Savlon* less than 1 and the administration of Povidone-Iodine more than 1

The halogenated phenol and phenol group compounds that have been widely used include phenol (carbolic acid), cresol, para chloro cresol and para chloro xylenol. This group acts by denaturing in a time range of about 10-30 minutes and is commonly used in aqueous solutions with a concentration of 0.1-5%. The application of the disinfection process is carried out for viruses and spores but is not suitable for killing certain types of Gram-positive bacteria and yeasts. The advantages of the halogenated phenol and phenol groups are that they are stable, persistent, and friendly to several types of materials, while the disadvantages include: difficult to biodegrade, are toxic, and corrosive (Rismana, 2008).

Conclusions and Suggestions

There is a significant difference in the effectiveness of *Savlon* antiseptic with povidone-iodine for wounds in white rats (Rattus norvegicus), with an average number of colonies of *Acinetobacter Baumannii* (CFU/mL) given Savlon antiseptic is 4.250±1.107 and 10% Povidone-Iodine is given antiseptic 3,500±1.154. p value = 0.000 ($p < 0.05$). Comparison of the effectiveness of *Savlon* antiseptic to Povidone-Iodine for wounds infected with *Acinetobacter Baumannii* in white rats (*Rattus Norvegicus*) 0%: 68.75 %. From the results of statistical tests on the effectiveness of *Savlon* antiseptic with Povidone-Iodine for wounds infected with *Acinetobacter Baumannii* in white rats (*Rattus Norvegicus*). It is recommended to use 10% Povidone-Iodine antiseptic.

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