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EFFECTIVENESS OF POLYHEXAMETHYLENE BIGUANIDE AMONG PATIENT WITH DIABETIC WOUND

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Abstract

Diabetic wounds are injuries that occur in patients with diabetes that involve disturbances in the peripheral and autonomic nerves. Diabetic wounds are a major complication of diabetes and a global public health problem. There is no wound-cleansing intervention using Polyhexamethylene Biguanide as a wound-cleansing fluid against diabetic wound biofilm. To identify the effect of Polyhexamethylene Biguanide on biofilm among patients with diabetic wounds. This research was a quasi-experiment with a pre-test and post-test approach. In this study, the research subject will be given to see a pre-test before the intervention. After that, a post-test will be given to see the final results of the intervention. The sampling technique was carried out by total sampling with a total of 30 respondents. This research instrument uses a biofilm observation sheet. The statistical test used was univariate and bivariate using paired sample t-test. The results showed that the average pre-test biofilm observation score was 7,63 ± 0,490 and the post-test 3,97 ± 0,765. The results of the study showed that there was a difference in the pre-test and post-test biofilm observation scores with a p-value of 0,000. After using Polyhexamethylene Biguanide on Biofilm on Diabetic Wounds, a p-value of <0,000 (p<0,05) was obtained so that Polyhexamethylene Biguanide was effective against Biofilm wound diabetic. Patients with Diabetic wounds are expected to be able to use Polyhexamethylene Biguanide as an effort to remove Biofilm and efforts in wound healing.

Keywords: Polyhexamethylene Biguanide, Biofilm, Patient With Diabetic Wound.

INTRODUCTION

Diabetic wounds are injuries that occur in patients with diabetes that involve disturbances in the peripheral and autonomic nerves. Diabetic ulcers are a major complication of diabetes and a global public health problem. Diabetic wounds will cause infection if not properly cared for, research results show that the average diabetic wound patient has an increase in leukocytes, this is the body's response to infection and inflammation as a result of the diabetic wound (Weir, D., & Swanson 2019). According to the International Diabetic Federation/IDF (2018), Approximately 463 million adults (20-79 years) are living with diabetes, in 2045 this will increase to 700 million (Federation ID 2018). Diabetes mellitus affected 415 million people in the world in 2015 and there was an increase in 2017 to 425 million. Based on the results of the 2018 Riskesdas data, it is estimated that in 2045 there will be an increase of 629 million people with diabetes mellitus. The prevalence of Diabetes Mellitus in Indonesia is high and continues to increase every year, with rates of 4-10% among the population with diabetes mellitus, with an incidence of diabetic ulcers during the lifetime of sufferers reaching 25%. Therefore, the prevalence of diabetes mellitus in Indonesia has the potential to be higher than the existing data. One of the main complications of diabetes mellitus is the development of diabetic wounds (Riskesdas 2018).

The diabetic wound is one of the complications in people with diabetes mellitus, confirming the prevalence of diabetic wound risk in Indonesia is still very high, namely 55.4% with a prevalence of diabetic wounds of 12.0%. (Carracher, Marathe, and Close 2018). In research conducted by Armstrong in 2020, it is estimated that one-third of the 500 million DM sufferers worldwide will be at risk of developing LKD, 17% will require amputation, 40% will experience a recurrence within 1 year, 65% within 5 years and 90% within 10 years Diabetic wounds and amputations are a consequence of diabetic neuropathy and peripheral arterial disease which are common and are major causes of morbidity and mortality in diabetics. Early recognition and treatment of patients with diabetes and feet at risk for injuries and amputations can delay or prevent more adverse outcomes (American Diabetes Association, 2018). Diabetic wounds are the leading cause of nontraumatic lower extremity amputations worldwide. Diabetic wounds in the long term also hurt the patient's self-concept, self-esteem, quality of life, physical and emotional health, the patient's hope for recovery, and the patient's spiritual level. Several government programs in Indonesia, one of which is the Healthy Family Program for Chronic Disease Control, are to reduce the prevalence of diabetes mellitus. PROLANIS (Chronic Disease Management Program) is a health service system and a proactive approach that is carried out in a related way involving participants, health facilities, and BPJS Health for health care for BPJS Health participants who suffer from chronic diseases to achieve optimal quality of life at the cost of health services effective and efficient.

The principle of modern wound care management is to maintain and maintain a moist wound environment or to improve the wound healing process, maintain fluid and tissue loss, and cell death. From the results of Handayani's research (2016) regarding the effectiveness of modern dressing techniques, it was concluded that modern dressing techniques are more effective in retaining moisture in the wound and accelerating the growth of new tissue which will speed up the healing process of diabetic ulcers. The process of wound healing is something that needs to be considered because wound care determines the process of accelerating the growth of new tissue (granulation) including capillaries, collagen, and fibroblast cells as constituents of new cells that have been damaged by bacteria at the time of a diabetic ulcer. The choice of an antiseptic liquid with polyhexamethylene biguanide (PHMB) can be expected to increase the acceleration of granulation including capillaries, collagen, and fibroblast cells (Efendi, Kamal, and Margono 2021). In Sripriya and Jayaraj's study, wound care of Polihexamethylene Biguanide (PHMB) was faster in healing diabetes mellitus wounds which functioned to control bacterial colonization and wound infection with a lower risk within 6 weeks compared to the use of other antiseptic fluids (Efendi, Kamal, and Margono 2021). Based on the results of a preliminary study obtained by the Wocare Center Bogor data for 2021, the number of patients who have treated wounds is 763. The number of patients with chronic wounds in 2021 is categorized into the 5 largest cases, namely Diabetic Foot Ulcers with a percentage of 51%, Pressure injuries with a percentage of 9%, venous leg ulcers with a percentage of 6%, arterial ulcers with a percentage of 5%, and chronic wounds with a percentage 5%. From the results of interviews with nurses at the Wocare Center Bogor, data was obtained that wound care had used modern dressing methods that were more effective in retaining moisture in the wound, one of which was Polyhexamethylene Biguanide which functions as an anti-microbial.

RESEARCH METHODOLOGY

The research design used by researchers in this study is a type of quantitative research. The design of this research is a Quasy Experiment without control with a pretest–posttest approach. The research design aims to provide a clear and structured guide to researchers in conducting their research. This study carried out an initial assessment through a pretest, then given an action or intervention, after which it was continued by giving a posttest so that changes could be seen after being given an action or intervention (Matsuroh et al., 2018).

The population in this study were all patients who suffered from diabetic wounds from 21 November 2022 to 13 January 2023 at the Wocare Center Bogor. The sampling technique in this study is the Nonprobability sampling technique with Total Sampling where the determination of the sample is based on the number of all respondents in the population to be used as a sample. The samples obtained in this study were 30 respondents, namely Diabetic wound patients at the Wocare Center Bogor. This research was conducted at Wocare Bogor. This Wocare Center is located on Jl. Sholeh Iskandar No. 9 Cibadak, Kec. Cereal Land, Bogor City, West Java Indonesia 16166. The instrument for this study used the Biofilm Assessment Sheet. The Biofilm Assessment Sheet is a measuring instrument in the form of a sheet containing several questions that refer to the characteristics of biofilm in diabetic wounds, as well as demographic data from respondents. The characteristics of the biofilm sheet are 8 points, namely the color of the wound is bright red, there is a shiny layer on the surface of the wound, the edges of the wound do not blend with the wound bed, the wound is contaminated, there is exudate, and there is a slimy layer (Banu et al. 2015). Data processing in this study has several stages, namely, the researcher will input data from the results of the study and interviews on the BWAT sheet. Re-checking to anticipate errors or lack of data needed for answers given by respondents. The coding stage for grouping data from the answers given by respondents according to research variables. The purpose of coding is to simplify the tabulation process and the next stage of data analysis. Next, the stage in data processing is by entering data into a table with a statistical program on the computer.

RESULT

Distribution of frequency characteristics of respondents based on Gender.

Age	Frequency (N)	Percent %
Early Adulthood (26-35)	1	3,3
Late Adulthood (36-45)	2	6,7
Early Elderly (46-55)	5	16,7
Late Elderly (56-65)	8	26,7
Old Human (>65)	14	46,7
Totaly	30	100,0

Distribution of frequency characteristics based on the rating of blood sugar GDS (Gula darah sewaktu).

Indicator of blood sugar	Pre-Test		Post-Test	
	Frequency	Percent	Frequency	Percent
Low (<200)	1	3,3	5	16,7
High (>200)	29	96,7	25	83,3
Totaly	30	100,0	30	100,0

Based on the results of the table regarding the frequency distribution based on sex from 30 respondents, it was obtained that 12 (40.0%) were male and gender 18 women (60.0%). Based on the results of the gender distribution, the majority (60.0%) of the respondents at the Bogor Wocare Center are women. Based on the results of the table regarding the frequency distribution based on age, from 30 respondents obtained Early Adults (26-35) as many as 1 (3.3%) respondents, Late Adults (36-45) 2 (6.7%) respondents, Early elderly (46 -55) 5 (16.7%) respondents, late elderly (56-65) 8 (26.7%) respondents, seniors (> 65) 14 (46.7%) respondents. Based on the results of the age distribution, the majority (46.7%) of respondents at the Bogor Wocare Center are seniors (> 65). Based on the results of the table regarding the frequency distribution based on the GDS Pre-Test, 1 (3.3%) of the 30 respondents obtained a Low GDS (<200) and a High GDS (>200) of 29 (96.7%) respondents. In the GDS Post-Test measurement, 5 (16.7%) respondents obtained Low GDS (<200) and 25 (83.3%) High GDS respondents. From the results of the GDS Pre-Test and Post-Test measurement distribution, the majority of Wocare Center Bogor respondents have a high GDS (> 200).

Results of Bivariate Analysis Normality

Tests of Normality			
	Shapiro-Wilk		
	Statistic	df	Sig.
Result	,950	30	,172
a. Lilliefors Significance Correction			

Based on the results of the Shapiro-Wilk normality test, Sig. equal to 0.172 > 0.005 which means that it is normally distributed, or is parametric data, namely using a paired sample t-test. Differences in the values of the Biofilm Assessment Sheets before and after being given Polihexamethylene Biguanide. The test results for differences in the values of the Biofilm Assessment Sheets before and after being given Polihexamethylene Biguanide using the paired sample t-test obtained a p-value of 0.000 (p <0.05), which means H_0 is rejected and H_1 accepted, which means there is a difference between the value of the Biofilm Assessment Sheet before and after being given Polihexamethylene Biguanide to diabetic wound patients at the Wocare Center Bogor.

		Mean	N	Std. Deviation	p-value
Result	PreTest	7,63	30	0,490	0,000
	PostTest	3,97	30	0,765	

DISCUSSION

Wound conditions before and after being given Polyhexamethylene Biguanide. Bivariate results by testing the difference in the value of the Biofilm Assessment Sheet before and after being given Polyhexamethylene Biguanide using a paired sample t-test obtained a p-value of 0.000 (p <0.05) which means H0 is rejected and H1 is accepted which means there is a difference between the value of the Biofilm Assessment Sheet before given Polyhexamethylene Biguanide and after being given Polyhexamethylene Biguanide to diabetic wound patients at Wocare Center Bogor. Based on the results, the average value of the observation was 7.63 from 8.00 in the observation during the pre-test to 3.97 during the post-test. Based on the study of 30 diabetic wound respondents, it was found that all respondents had biofilm during the pre-test and there was no biofilm during the post-test. So it can be concluded that the

use of polyhexamethylene biguanide is effective as a wound-washing fluid in diabetic wound biofilms in Wocare Bogor. This is in line with research conducted by Nurlany, Damanik, and Hamka (2021) which examined the effectiveness of using Polyhexamethylene Biguanide Wound Cleaning Liquid with Nano Silvosept Spray in Reducing Biofilm in Diabetic Foot Ulcers where in each case there was a decreased in the good score with polyhexamethylene wound cleansing fluid biguanide.

The decrease in each score occurred both overall and focused on the condition of the biofilm, one of which was marked by a decrease in exudate in the wound. In the study, it appears that when there is a biofilm on the wound, granulation tissue will not be visible in the wound because it is covered by the biofilm and will inhibit the wound from healing. This is as stated in (Ricci 2016), where wound recovery is also influenced by factors, such as bacterial infections that produce biofilms, potassium levels, and wound fluids. The presence of biofilm on the wound bed can inhibit phagocytic activity of polymorphonuclear neutrophils. The presence of a bacterial biofilm is thought to be a barrier to the wound's natural progression towards healing. Biofilms play an important role in the inability of chronic wounds to heal. It is estimated that more than 90% of chronic wounds contain bacteria and fungi that live in biofilms (Bowen and Richardson 2016). The claim that biofilm is visible in wounds with a shiny, translucent, slimy coating at the wound bed has been used as a clinical sign of biofilm, especially if it returns quickly after sharp debridement (Pathogens 2021). Based on the results of the study, in terms of observation using the Biofilm Assessment Sheet, all patients experienced a decrease in each score. This is because the nurses use modern dressing techniques during the treatment process to achieve good patient recovery.

In all diabetic patients, wounds are handled using the 3M method, namely washing, removing dead tissue, and changing dressings. To remove the biofilm in the wound, use methods such as washing the wound using polyhexamethylene biguanide, washing it clean, drying it using gauze, cleaning the biofilm using gauze, or using mechanical debridement techniques, namely using scissors, tweezers, and gauze. Biofilm greatly inhibits the wound process towards healing, one of which is inhibiting the wound epithelial process, because of the moist concept that exists in polyhexamethylene biguanide and assisted by mechanical debridement techniques to remove dead tissue, good wound tissue will be seen so that the dressing used can work more effectively against wound healing process. Based on the results of this study it appears that all patients using polyhexamethylene biguanide wound washes did not show any side effects when using it, which means that this liquid is safe for the body. In addition, moist techniques in wound care must also be considered. for wet and dry dressings, if the wound has a large amount of exudate, the dressing must be changed immediately. Especially if the exudate seeps out of the dressing which causes the dressing to become dirty. Wound care with dry wet dressings will be very difficult if you want to open the dressing, because the dressing becomes dry, will cause pain and also bleeding when the dressing is removed, and can damage cells. The moist wound healing technique is a wound handling technique by keeping the wound moist so that it can facilitate cell movement in the wound, and can speed up the granulation process in the wound. Apart from that, in the implementation of diabetic wound care with biofilm, it is also necessary to pay attention to all aspects of comfort for patients to increase service satisfaction and good feedback for the institution itself.

CONCLUSION

Characteristics of patients at the Bogor Wocare Center based on the majority sex were women as much as 60%, based on age the most were late elderly and seniors as much as 46.7%, and based on the results of the GDS Pretest the majority of high GDS (> 200) was 96.7% and Posttest decreased even though the majority were high (> 200) but decreased to as much as 83.3% because the GDS of the respondents was controlled. There was a decrease in the score of the Biofilm Assessment Sheet in all patients after using polyhexamethylene biguanide as a wound-washing fluid in diabetic wounds. A decrease in each score will occur both as a whole and only focusing on biofilm conditions. There was a change in biofilm in diabetic wounds before and after the use of polyhexamethylene biguanide as a wound-washing fluid. Polyhexamethylene biguanide is effective as a washing fluid for diabetic wounds at the Bogor Wocare Center.

Conflict of Interest

This Research did not have a conflict of interest with any party, this research was carried out entirely by the researcher.

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