

The Relationship Between Antimicrobial Dressing Application and the Healing Process of Diabetic Foot Wounds at Griya Sehat Wocare, Bogor, Indonesia

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Abstract

Introduction: Diabetic foot ulcer is one of the complications observed in patients with uncontrolled diabetes mellitus (DM). The World Health Organization (WHO) reported that there were 1.3 million deaths due to diabetes mellitus, while according to the Ministry of Health, the prevalence of diabetes in Indonesia reached 10.9% in 2019 and increased to 11.7% in 2023. One effective treatment method is modern dressing with antimicrobials, which helps inhibit bacterial growth and accelerate wound healing. **Objectives:** To analyse the relationship between the use of antimicrobial dressings and the healing process of diabetic foot ulcers among patients at Griya Sehat Wocare Bogor. **Methods:** This study employed a quantitative design with a cross-sectional approach. The sampling technique used was total sampling. The sample size comprised 30 patients with diabetic foot ulcers who received treatment at Griya Wocare Bogor. Data were collected using the Winner Scale assessment sheet and analysed using the Chi-square statistical test. **Results:** The results showed that the majority of patients used silver antimicrobial dressings. Statistical analysis indicated a significant relationship between the use of antimicrobial dressings and the healing process of diabetic foot ulcers, as demonstrated by the Chi-square test results ($p < 0.05$). **Conclusions:** Antimicrobial dressings are associated with accelerated healing of diabetic foot wounds. Therefore, this method is recommended as a standard of care for diabetic foot wounds to reduce the risk of further complications.

Keywords: Antimicrobial Dressing; Diabetic Foot Ulcer; Diabetes Mellitus; Wound Healing

Introduction

Diabetic ulcers are defined as wounds experienced by patients with nerve damage and peripheral vascular disease. Diabetic wounds are difficult to heal primarily due to neuropathy and impaired circulation. When these wounds are not properly managed, they can lead to a decline in health and increased pain in the body (Lin *et al.*, 2021). The World Health Organization (WHO) reported that there are 1.3 million deaths worldwide caused by diabetes mellitus. Most patients are between 45 and 54 years old. Since 1980, diabetes mellitus has been experienced by some patients and has continued to increase very rapidly up to 2024. In 2023, cases of diabetes mellitus (DM) worldwide totalled 442 million people. This number is considered high and indicates that people have unhealthy lifestyles (Wulandari, 2024). According to the Ministry of Health, the prevalence of diabetes mellitus in Indonesia reaches 8.49 million people. In 2019, the prevalence of diabetes in Indonesia was already 10.9%, and in 2023, it increased to 11.7%. This indicates an annual increase in the number of diabetes patients in Indonesia (Kementerian Kesehatan Republik Indonesia, 2023).

The government plays a very important role in providing facilities to improve healthcare services for patients. In addition, the government must plan appropriate programmes to offer assistance to patients in curing diabetes mellitus. Furthermore, the success of the government's strategy also requires the involvement of nurses to help implement these programmes effectively. Nurses play a crucial role in assisting the government in delivering professional healthcare services. During the wound-healing phase of diabetes mellitus, the role of nurses is essential in addressing the patient's disease-related problems. Additionally, nurses possess adequate knowledge and experience to carry out the planned practices (Beaudin *et al.*, 2025).

Wounds in patients with diabetes mellitus can be managed using modern dressings. However, in Indonesia, only about 2.4 per cent of patients receive this treatment. Although modern dressing techniques play an important role in accelerating the healing process of diabetic wounds by combining topical medications and plasma membranes to speed up tissue recovery, healthcare facilities in Indonesia have not yet widely implemented these techniques optimally. One type of modern dressing is antimicrobial dressing, which is a medical dressing used to help inhibit bacterial growth on wounds. Antimicrobial dressing is applied to combat bacteria that appear on wounds. By using antimicrobial dressings, patients can keep their wounds clean and free from infection, thereby accelerating the healing process (Vivcharenko *et al.*, 2023).

Previous studies have shown that the use of modern dressings influences the healing process of diabetic foot wounds, specifically through the application of antimicrobial dressings, including their use as a primary dressing. Essentially, the application of antimicrobial dressings can provide effective results in the healing process of foot wounds. The healing process for diabetic foot wounds lasts between 3 and 19 days when using silver dressings. Each wound-healing process that employs antimicrobial dressings can effectively promote recovery in foot wounds. In addition to silver dressings, antimicrobial dressings may also include cadexomer iodine or honey dressings to prevent wound infection. Choosing the correct dressing greatly enhances the effectiveness of the foot wound-healing process. This indicates that the appropriate use of antimicrobial dressings supports rapid wound healing (Ma *et al.*, 2024).

The effectiveness of footwound treatment significantly contributes to faster wound healing. Wound care using antimicrobial dressings effectively promotes recovery by providing treatment that assists patients in healing foot wounds (Karina *et al.*, 2024). Based on a preliminary study conducted at Griya Sehat Wocare, Bogor, data indicated that healthcare services there utilise antimicrobial treatments.

Methodology

This research adopts a quantitative approach with a non-experimental or observational design through a cross-sectional method, in which data are collected simultaneously at one point in time between risk factors and their impact (point time approach). This means that all observed variables (independent and dependent) are examined concurrently, allowing for a single observation of each subject with measurements taken during the examination period. The study aims to analyse the relationship between the combination of independent and dependent variables (Creswell & Creswell *et al.*, 2022).

Data collection was conducted in stages and adjusted according to the conditions during the research. To determine the sample, a total sampling technique was applied, referring to the population at Griya Sehat Wocare Bogor. The study population consisted of diabetic foot ulcer patients undergoing wound care at Griya Sehat Wocare Bogor from November to December 2024, totalling 30 patients. The research sample comprised 30 patients with diabetic foot ulcers who received treatment at Griya Sehat Wocare Bogor during November–December 2024.

Sampling was conducted using a non-probability sampling technique with a total sampling approach, in which the entire population was used as the research sample. Total sampling, also known as saturated sampling, is typically applied when the population size is relatively small, allowing all members of the population to be included in the study. The research will be conducted from October 2024 to January 2025.

Ethical Consideration

The research obtained ethical clearance from the Sekolah Tinggi Ilmu Kesehatan Pertamedika Jakarta, Indonesia, with reference number: 021/e-KEPK/FIKES/XII/2024 on 3rd December 2024.

Results

Table 1: Frequency Distribution of Respondent Characteristics

Age	Frequency (N)	Percentage (%)
Early Adulthood (26-35 years)	0	0
Late Adulthood (36-45 years)	6	20
Early Old Age (46-55 years)	5	16.7
Late Old Age (56-65 years)	11	36.7
Elderly (> 65 years)	8	26.6
Gender	Frequency (N)	Percentage (%)
Male	14	46.7
Female	16	53.3
Frequency Distribution Based on Duration of Diabetes		
Duration of DM	Frequency (N)	Percentage (%)
<10 Year	16	53.3
≥10 Year	14	46.7
Frequency Distribution Based on Antimicrobial Dressing Type		
Types of Antimicrobial Dressings	Frequency (N)	Percentage (%)
Cadexomer Iodine	8	26.7
Silver	19	63.3
Dialkylcarbamoyl Chloride	3	10
Frequency Distribution of the Wound Healing Process of Diabetic Foot Ulcers at Griya Sehat Wocare Bogor		
Healing process	Frequency (N)	Percentage (%)
Regenerative	17	56.7
Degenerative	13	43.3

Based on Table 1, regarding the frequency distribution of age, most respondents at Griya Sehat Wocare Bogor fall into the late elderly category (56–65 years old), with 11 respondents (36.7%). This is followed by the elderly group (>65 years old) with 8 respondents (26.6%), late adulthood (36–45 years old) with 6 respondents (20%), and early elderly (46–55 years old) with 5 respondents (16.7%).

In terms of the frequency distribution of gender, most respondents at Griya Sehat Wocare Bogor are female, comprising 16 respondents (53.3%), while there are 14 male respondents (46.7%). Regarding the frequency distribution of the duration of diabetes mellitus, most respondents at Griya Sehat Wocare Bogor have had diabetes mellitus for less than 10 years, totalling 16 respondents (53.3%), while 14 respondents (46.7%) have had it for more than 10 years.

The frequency distribution of antimicrobial dressing types shows that most respondents at Griya Sehat Wocare Bogor used silver dressings, with 19 respondents (63.3%), followed by cadexomer iodine with 8 respondents (26.7%), and dialkylcarbamoyl chloride with 3 respondents (10%).

The frequency distribution of the diabetic foot wound healing process shows that most respondents experienced healing within the regenerative process category, with 6.7% of respondents showing regenerative processes, while one respondent (3.3%) experienced degenerative processes, with a total of 3 respondents (10%).

The statistical test results using the Chi-square test showed a p-value of 0.008 ($p < 0.05$), indicating a significant relationship between the use of antimicrobial dressings and the healing process of diabetic foot wounds at Griya Sehat Wocare Bogor.

Table 2: The Relationship between Antimicrobial Dressing Application and the Healing Process of Diabetic Foot Wounds at Griya Sehat Wocare, Bogor

Antimicrobial dressing	Regenerative		Degenerative		Total		p value
	N	Percentage (%)	N	Percentage (%)	N	Percentage (%)	
Cadexomer Iodine	5	16.7	3	10	8	26.7	0.008
Silver	10	33.3	9	30	19	63.3	
DACC	2	6.7	1	3.3	3	10	
Total	20	56.7	10	43.3	30	100	

Based on Table 2, data were obtained regarding the healing process of diabetic foot wounds according to the type of antimicrobial dressing used. Five respondents (16.7%) who used cadexomer iodine experienced regenerative healing, while three respondents (10%) experienced degenerative healing, totalling eight respondents (26.7%). For the silver type, 10 respondents (33.3%) showed regenerative processes, while nine respondents (30%) experienced degenerative processes, totalling 19 respondents (63.3%). Meanwhile, two respondents who used DACC (Dialkylcarbamoyl Chloride) showed regenerative processes (6.7%), while one respondent (3.3%) experienced degenerative processes, bringing the total to three respondents (10%). The statistical test results using the Chi-square test showed a p-value of 0.008 ($p < 0.05$; $df = 2$), indicating a significant relationship between the use of antimicrobial dressings and the healing process of diabetic foot wounds at Griya Sehat Wocare Bogor.

Discussion

The research results show that many diabetic wound patients are elderly individuals aged between 56 and 65 years (36.7%), with the majority being female (53.3%). This is supported by Listrikawati *et al.* (2023), who stated that elderly individuals aged around 56 to 65 years are more likely to experience diabetes. This age group is considered vulnerable because increasing age can lead to changes in the body's metabolism. As people get older, the ageing process has a significant impact on their lives and bodily systems. Furthermore, it is known that women are more likely to develop diabetes due to lifestyle patterns that affect their physical condition.

In general, patients with diabetes mellitus have had the condition for over ten years. According to Amirrah *et al.* (2022), patients who have had diabetes for more than ten years are at higher risk compared to those who have had it for less than ten years. This is because such patients may experience damage to blood vessels and nerves, which affects the immune system. Additionally, they are more prone to severe complications and difficulties in controlling blood sugar levels in the body. Some of the most effective types of antimicrobial dressings are those containing silver. Wang *et al.* (2021) explain that silver dressings are among the most frequently used antibacterial agents in wound care. Their mechanism of action is particularly beneficial as they help eliminate bacteria from wounds.

The research results show that 56.7% of respondents with diabetic foot ulcers who were given antimicrobial dressings experienced regenerative healing, while 43.3% experienced degenerative healing. This indicates that more than half of the respondents experienced progressive tissue improvement. Antimicrobial dressings can accelerate wound healing by promoting granulation tissue growth and reducing the risk of infection.

Based on the research data, there is a significant relationship between the application of antimicrobial dressings and the healing process of diabetic foot wounds at Griya Sehat Wocare Bogor, with a p-value of 0.008 ($p < 0.05$). This result aligns with previous research showing that the use of antimicrobial dressings can positively influence the healing process of diabetic foot ulcers. This treatment is designed to help accelerate wound healing through the use of dressings. The research findings also indicate that the use of antimicrobial dressings assists diabetic patients in reducing wound infections. With the use of antibacterial dressings, patients can achieve faster wound healing (Thomas *et al.*, 2021).

Basically, a person with diabetes mellitus will attempt to protect wounds from infection. However, there are many treatment techniques that need to be carried out. In this case, the rapid wound-healing

process requires the assistance of experienced medical personnel to be more effective. Every wound in a diabetic patient must be kept moist — not too dry and not too wet — as this condition helps accelerate the healing process of foot wounds. According to Puspita *et al.* (2021), the management of diabetic wounds requires more modern healing methods to promote faster recovery. Wound care for diabetic patients generally takes longer to heal; therefore, it is necessary to use appropriate medication to expedite the healing process (Khasanah *et al.*, 2022).

The application of antimicrobial dressings such as cadexomer iodine, DACC, and silver dressings showed regenerative outcomes. Essentially, cadexomer iodine is an effective antimicrobial agent in the treatment of chronic wounds because it helps reduce infection. This is supported by Arisudhana *et al.* (2022), whose previous research demonstrated that modern dressings are more effective for use in wound care compared to other techniques. Based on the researcher's assumptions, it can be concluded that there is a significant relationship between the application of antimicrobial dressings and the foot wound-healing process in diabetic patients. This indicates that the use of antimicrobial dressings such as cadexomer iodine, DACC, and silver dressings can contribute to improving the healing process of foot wounds in diabetic patients.

Conclusion

The findings of this study demonstrate a significant relationship between the application of antimicrobial dressings and the healing process of diabetic foot wounds among patients treated at Griya Sehat Wocare Bogor, Indonesia. The majority of patients who received antimicrobial dressings, particularly those containing silver, experienced a faster and more effective regenerative healing process compared to other dressing types. This underscores the clinical importance of incorporating antimicrobial dressings into standard diabetic wound care protocols to minimize infection risk, enhance tissue regeneration, and reduce healing time. The study further highlights the crucial role of nursing professionals in providing evidence-based wound management and patient education to improve overall treatment outcomes. Future research with larger samples and longitudinal designs is recommended to validate these findings and explore the long-term effectiveness of various antimicrobial dressing materials in diabetic wound care.

Conflict of Interest

The authors affirm that they have no conflicting interests.

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