CASE STUDY: APPLICATION OF POLYHEXAMETHYLENE BIGUANIDE (PHMB) COMPRESSES ON WOUND HEALING IN PATIENTS WITH DIABETIC ULCER INFECTIONS

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Abstract

Background: Diabetes mellitus is one of the diseases that is a major concern because its incidence continues to increase. One of the complications that occurs is diabetic ulcers that attack from the subcutaneous tissue to the bone. Diabetic ulcer infections can be characterised by pain, swelling, redness, exudate, biofilm, odour, and necrosis. If wound care is not handled properly, it will worsen the condition of the wound. Wound care needs to include the application of PHMB fluid compresses and PHMB gel to diabetic ulcer patients to address skin integrity damage. Objective: This study aims to examine the effectiveness of PHMB compresses and PHMB gel in diabetic ulcer patients. Method: This study uses a case study method. The sample in this case study consisted of two individuals: patient 1, aged 65, who had a diabetic ulcer with a wound on the left thumb and infection; and patient 2, aged 47, with a wound on the left foot and infection. Results: The results showed that the application of PHMB on diabetic ulcers led to an improvement in wound healing. This was indicated by the REEDA (Redness, Edema, Ecchymosis, Discharge, Approximation) score in patient 1, which was 7 before treatment and 3 after treatment. Meanwhile, in patient 2, the score before treatment was 10 and after treatment it was 3. Conclusion: The application of PHMB compresses and PHMB gel is effective in reducing the degree of infection and skin integrity damage in diabetic ulcers.

Keyword: Compresses PHMB, diabetic ulcer, REEDA

INTRODUCTION

Diabetes mellitus is one of the diseases that is a major concern because its incidence continues to increase every year. This disease is characterised by high blood glucose levels due to metabolic disorders and hormonal disturbances. Blood glucose levels are controlled by the hormone insulin, which is produced by the pancreas. In people with diabetes, insulin does not function effectively, resulting in insulin resistance. This condition can cause various complications, including disorders of the kidneys and blood vessels (Salsabila et al., 2024).

According to the International Diabetes Federation, in 2024 there will be approximately 589 million adults aged 20–79 worldwide living with diabetes, with 3.4 million deaths per year or one death every 9 seconds (IDF, 2025). Based on data from the Indonesian Ministry of Health (Kemenkes RI), the number of people with diabetes in Indonesia in 2024 reached 19.5 million and is estimated to increase to 28.6 million by 2045 if not seriously addressed. The mortality rate due to diabetes in Indonesia in 2023 was recorded at 57.42 per 100,000 population (Profil Kesehatan RI, 2024).

One of the serious complications of diabetes is diabetic ulcers, which are wounds on the lower extremities caused by vascular disorders and neuropathy. This condition can cause open wounds that spread to the subcutaneous tissue, tendons, bones, or joints. The wound can be partial thickness or full thickness depending on the extent of tissue damage. Diabetic ulcer patients often experience an increase in leukocytes in response to infection, which slows down wound healing by prolonging the inflammatory phase (Eliance, 2023).

Diabetic ulcer infection is characterised by pain, swelling, redness, excessive exudate, biofilm, lack of granulation growth, odour, and necrosis. If not treated properly, this condition can lead to amputation in up to 57.14% of cases. The impact of amputation is not only physical, but also psychological and social, such as anxiety, depression, self-care deficits, and increased economic burden. Therefore, effective wound management is very important to prevent further complications (Maksum & Hamidah, 2025).

Wound management in diabetic patients includes pharmacological and non-pharmacological approaches. Pharmacologically, antibiotics such as amoxicillin, levofloxacin, and doxycycline can control infection. In severe infections, parenteral therapy with ampicillin or sulbactam is administered intravenously. Non-pharmacologically, wound care focuses on maintaining wound moisture and the use of antiseptic fluids, such as povidone iodine, sodium hypochlorite, hydrogen peroxide, and the recommended PHMB (Gero et al., 2025).

Polyhexamethylene biguanide (PHMB) is a broad-spectrum antiseptic that is effective against gram-positive and gram-negative bacteria and fungi that cause chronic wounds. PHMB reduces wound odour, reduces biofilm, accelerates granulation tissue growth, and supports the concept of moist wound healing (Hidayat et al., 2024). PHMB also does not cause pain when applied, making it more comfortable to use than other antiseptics. PHMB compress therapy for 10–15 minutes has been proven to reduce the number of bacteria in chronic wounds (Efendi et al., 2021).

Research by Fatimatuzahro et al. (2024) and Naziyah et al. (2024) shows that the use of PHMB as a modern wound compress fluid can accelerate the healing of diabetic ulcers. After 10 weeks of treatment, wound size decreased, granulation tissue grew optimally, exudate reduced, and epithelialisation increased. PHMB also reduced biofilm thickness, leading to faster wound improvement. This demonstrates that PHMB is effective and safe as a wound care solution for patients with diabetic ulcers

RESEARCH METHOD

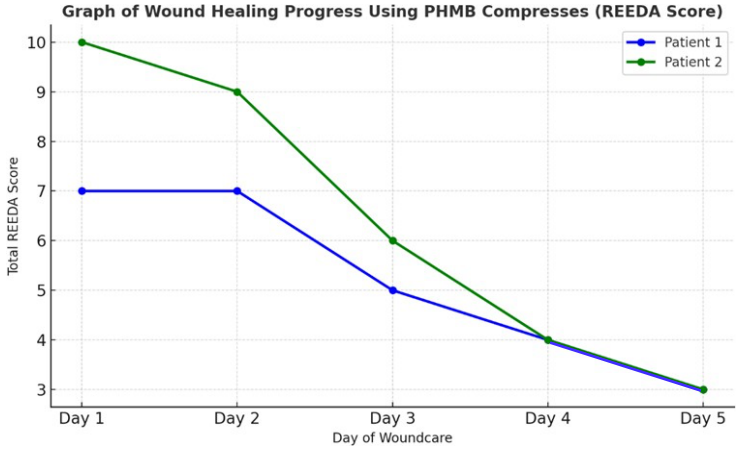
The research method used was a case study. The case study was conducted from 29 September 2025 to 3 October 2025. The subjects of this case study were inpatients with diabetic ulcer infections at Arifin Achmad Provincial Hospital in Riau. Inclusion criteria were: 1) Patients who were willing to be respondents and had agreed to informed consent, 2) Patients suffering from type II diabetes mellitus, 3) DM wounds on the feet (diabetic ulcers). Exclusion criteria were: 1) Patients without diabetic ulcers, 2) Patients with post-amputation wounds, 3) Patients with PHMB allergies. The sequence of the analysis process was data collection using an observation sheet containing patient identity (initials, age, gender, medical record number, diagnosis, wound location, and observation date), general data (history of DM, last blood sugar control, history of previous wounds, and history of amputation). Wound measurement

assessment used the REEDA assessment tool. REEDA (Redness, Edema, Ecchymosis, Discharge, and Approximation) is a wound healing assessment tool based on the amount of redness, swelling, bruising, exudate, and wound edge approximation (each scored between 0-3), with the final score being the sum of the item scores. A lower score indicates better healing. This is followed by wound healing assessment indicators measured by the reduction in the amount of exudate, necrosis, pain, and odour.

RESEARCH RESULTS

The results of the PHMB compress application were recorded from Monday, 29 September 2025 - 3 October 2025 during each morning shift, with the application taking place from 09:00 until completion.

Graph 1. Graph showing the results of the PHMB compress application



This graph shows the change in infection in diabetic ulcer wounds after wound treatment using PHMB compresses.

Table 1. Changes in wound healing after the application of PHMB compresses

Indicator	Patient 1					Patient 2				
	Day of Woundcare									
	1	2	3	4	5	1	2	3	4	5
Exudate	90%	85%	75%	70%	60%	60%	50%	35%	25%	15%
Necrosis	0	0	0	0	0	10%	8%	5%	4%	2%
Pain	5	4	3	2	1	5	4	3	2	1
Odour	4	3	3	2	1	5	4	3	3	2
Biofilm	0	0	0	0	0	15%	12%	8%	7%	5%

This graph shows the percentage change in the five wound healing indicators. All indicators show that the application of PHMB compresses is effective in reducing diabetic ulcer

infections. In terms of exudate, patient 1's wound decreased from 90% to 60%, while patient 2's exudate decreased from 60% to 15%.

Figure 1. Application of PHMB compress

Figure 2. Wounds on the first day and last day in Patient 1

Figure 3. Wounds on the first day and last day in Patient 2

DISCUSSION

Diabetic ulcer infection is a chronic complication in people with diabetes mellitus characterised by open wounds on the feet due to nerve damage (neuropathy), blood flow

disorders (angiopathy), and immune system problems caused by high blood glucose levels. Small wounds can develop into deep ulcers due to excessive pressure, improper care, or poor foot hygiene. Hyperglycaemia causes a decrease in the function of leukocytes in fighting infection, allowing bacteria to grow and worsen the wound. Factors such as wounds that are not treated immediately, a dirty, damp environment, and the use of inappropriate footwear also accelerate the onset of infection (Purnmawati & Jumaiyah, 2021).

The spread of infection to deeper tissues, leading to serious complications such as osteomyelitis or amputation, can occur if not treated properly. Therefore, wound care must be comprehensive, including blood sugar control, wound cleansing with antiseptic solutions, debridement of necrotic tissue, dressing that maintains optimal moisture, and offloading to reduce pressure on the wound. The main principle of care is to create a clean, moist, and infection-free wound environment so that granulation and epithelialisation processes can proceed optimally (Primadani & Safitri, 2021).

One method often used in the treatment of infected diabetic ulcers is PHMB compresses. PHMB is a modern antiseptic that works by destroying bacterial cell membranes without damaging healthy tissue around the wound (Tusyanawati et al., 2020). PHMB is chosen for its high effectiveness against various types of bacteria and its non-resistant properties, unlike antibiotics. The benefits of using PHMB include reducing microbial load, accelerating healing, reducing wound odour, and lowering the risk of reinfection (Maria et al., 2023).

The procedure performed on the first day was autolytic debridement on both of the patient's wounds. Then, a PHMB compress was applied for 10 minutes by pouring it onto the wound surface that had been covered with sterile gauze. After 10 minutes, the compress was removed. PHMB gel and honey were applied depending on the characteristics of the wound. After application to the wound, the wound was covered with gauze (Armi et al., 2023). On subsequent days, wound care was performed using mechanical debridement and PHMB compresses until day 5. Based on the results of wound care using PHMB compresses for 5 days, both patients showed improvement in their wounds. Research conducted by Faridah (2024) also proved that PHMB compresses are effective in treating diabetic ulcer infections.

CONCLUTIONS

The results of this application demonstrate that there is consistency with the outcomes achieved, namely improved wound healing, particularly in terms of granulation, exudate, and biofilm reduction. The wound condition of Patient 1 and Patient 2 improved after implementing measures such as blood sugar control, nutrition management, mobility support, debridement, and wound care using PHMB compresses and PHMB gel. Chronic wounds can produce excessive exudate and biofilm if not properly managed. This becomes an obstacle in the process of proper wound healing. Therefore, chronic wounds require antiseptics and antimicrobials that are impregnated or appropriate gel dressings to reduce and eliminate exudate and biofilm. The application of PHMB compresses and PMHB gel is effective in reducing the incidence of diabetic ulcer infections.

REFERENCE

Armi, A., Fitriani, D., Sartika, M., & Setiawan, Y. (2023). The effectiveness of wound caring technique with polyhexamethylene biguanide and dialkyl carbamoyl chloride to healing

process duration of diabetic foot ulcer patient. Jurnal Keperawatan Padjadjaran, 11(1), 18–24. https://doi.org/10.24198/jkp

Efendi, F., Kamal, S., & Margono. (2021). Aplikasi Polihhexamethylene Biguanide gel pada penderita Diabetes Mellitus dengan kerusakan integritas kulit. In Borobudur Nursing Review (Vol. 01, Issue 01).

Eliance, M. (2023). Efektifitas Polyhexamethylene Biguanide (PHMB) Terhadap Odor Pada Luka DIabetik di Klinik Wocare Center Bogor Jawa Barat Tahun 2023 [Prodi Keperawatan]. Universitas Nasional.

Fatimatuzahro, S., Naziyah, N., & Bahri, K. (2024). Analisis Asuhan Keperawatan melalui Intervensi Polyurethane Foam sebagai Absorbent pada Tn.H dan Ny.N dengan Ulkus Kaki Diabetikum di Wocare Center Kota Bogor. Jurnal Kreativitas Pengabdian Kepada Masyarakat (PKM), 7(4), 1601–1612. https://doi.org/10.33024/jkpm.v7i4.13707

Gero, S., Tuminting, J., & Widyanigsih. (2025). Efektivitas Perawatan Luka Konvesional Dressing Modifikasi Ekoenzim Terhadap Perubahan Skor Winners Scale pada Ulkus Diabetes Mellitus (Vol. 2, Issue 1). https://jurnal.yscs.co.id/index.php/jik

Hidayat, R., Naziyah, N., & Sembiring, T. (2024). Analisis Asuhan Keperawatan Pada Biofilm di Luka Kaki Diabetik pada Ny. M dan Ny.L Dengan Penggunaan PHMB sebagai Cairan Pencuci Luka di Klinik Wocare Center Bogor. Jurnal Kreativitas Pengabdian Kepada Masyarakat (PKM),7(1), 111–139. https://doi.org/10.33024/jkpm.v7i1.12481

IDF. (2025). Global Diabetes global report 2000 — 2050. Optima. https://diabetesatlas.org/data-by-location/global/?utm_source

Kemenkes RI. (2024, July19). Cegah Dini Ancaman Diabetes. Indonesia.GO.ID Portal Informasi

Maria, G. N., Rotty, M., & Katuuk, M. E. (2023). Efektivitas Air Mineral Untuk Pencucian Luka Kronis. *Jurnal Keperawatan*, *11*(1), 81–85.

Primadani, A. F., & Safitri, D. N. P. (2021). Proses Penyembuhan Luka Kaki Diabetik Dengan Perawatan Luka Metode Moist Wound Healing. *Ners Muda*, *2*(1), 9–16. https://doi.org/10.26714/nm.v2i1.6255

Profil Kesehatan RI. (2024, February 1). Jumlah Penderita Diabetes di Indonesia Meningkat Pesat. *Eka Farm*. https://www.ekafarm.com/diabetes-di-indonesia/?utm_source

Purnamawati, D., & Jumaiyah, W. (2021). Efektivitas Penggunaan Antimicrobial Dressing Terhadap Lama Proses Penyembuhan Luka pada Pasien. *Jurnal Penelitian Kesehatan Suara Forikes*, *12*(1), 80. https://doi.org/10.33846/sf12nk115

Salsabila, S., Naziyah, N., & Bahri, K. (2024). Analisis Asuhan Keperawatan melalui Penggunaan Teknik Conservative Sharp Wound Debridement (CSWD) pada Tn. H dan Ny. S dengan Diagnosa Diabetic Foot Ulcer di Wocare Center Kota Bogor. *Jurnal Kreativitas Pengabdian Kepada Masyarakat (PKM)*,*7*(4), 1589 1600.https://doi.org/10.33024/jkpm.v7i4.13701

Tusyanawati, V. M., Sutrisna, M., & Tohri, T. (2020). Studi Perbandingan Modern Dressing (Salep Tribee) dan Konvensional Terhadap Proses Penyembuhan Luka Pada Pasien Post Operasi Apendiktomi. *JPPNI*, *1*, 1– 8.