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Implementation of Modern Wound Care Hydrogel Dressing in Patients with Diabetic Ulcers

Salsya Haerani[1], Ade Fitriani[1], Dadi Hamdani[1]
[1]STIKes Muhammadiyah Ciamis, West Java, Indonesia

Correspondence author: Ade Fitriani
Email: salsyahaerani.02@gmail.com
Address: STIKes Muhammadiyah Ciamis, Jl. K.H. Ahmad Dahlan No. 20, Ciamis, West Java, Indonesia
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ABSTRACT

Introduce: *Diabetes mellitus* is a chronic metabolic disease that can cause various complications, one of which is diabetic ulcers. These ulcers occur due to impaired circulation and peripheral neuropathy, which causes wounds to be difficult to heal and increases the risk of amputation. One method of wound management that has proven effective in accelerating the healing of diabetic ulcers is the use of modern hydrogel dressings. Hydrogel functions as a *moist dressing* that is able to maintain optimal moisture in the wound area, accelerate the process of autolysis of necrotic tissue, and stimulate the growth of granulation tissue. With a moist and protected wound environment, the process of tissue regeneration is more effective and infection can be minimized.
Objective: This case study is to evaluate the effectiveness of using *modern hydrogel dressing* as a moist dressing in accelerating wound healing in patients with diabetic ulcers through a nursing care approach**.**
Methods: This research is a case study with a descriptive method, using a nursing care approach that includes assessment, nursing diagnosis, intervention, implementation, and evaluation. The patient's house is located in the Sinar Mawar Neighborhood Hamlet, RT.001 RW.008, Cigembor Village, Ciamis District. Nursing diagnoses refer to (SDKI), interventions based on (SIKI), and evaluation based on (SLKI), and all documentation is compiled using the SOAPIER method.
Results: Interventions were carried out on one patient with grade 4 diabetic ulcers. Wound care using *hydrogel* as a moist dressing was performed for 3 visits. Wound evaluation was carried out using the Bates-Jensen Wound Assessment Tool as well as real-time blood sugar (GDS) checks. Results showed a decrease in wound score from 45 to 38, and a decrease in GDS from 518 mg/dl to 269 mg/dl. There were significant changes in the wound tissue, such as the reduction of slough tissue and the formation of healthy granulation tissue.
Conclusion: The use of *modern hydrogel dressing* as a moist dressing in accelerating diabetic ulcer wound healing. This implementation can be an option for modern non-pharmacological wound care therapy that can be applied at home with a holistic nursing approach.

Keywords: diabetes mellitus, diabetic ulcer, hidrogel, moist dressing, modern dressing

Introduction

Diabetes mellitus (DM) is a non-communicable disease whose prevalence continues to increase globally and nationally. Based on the International Diabetes Federation (IDF) report, in 2017 there were approximately 425 million adults living with DM worldwide, and the number is predicted to increase to 629 million by 2045. In Indonesia, Riskesdas data in 2013 showed a DM prevalence of 1.5%, which increased to 2.0% in 2018. In West Java Province, the incidence of DM has also increased significantly. Based on data from the West Java Health Office in 2020, the number of people with DM reached 1,078,857 people, with the highest distribution in Bekasi Regency and the lowest in Ciamis City (Amalia et al., 2021) .

DM is a chronic metabolic disorder characterized by hyperglycemia due to disturbances in insulin secretion, insulin action, or both. Uncontrolled hyperglycemia can cause damage to the vascular and neurological systems, including peripheral neuropathy and peripheral arterial disease (PAD). One of the major complications of these conditions is diabetic ulcers, which are chronic wounds that result from a combination of local trauma, sensory impairment and impaired blood flow. These ulcers mainly occur in the lower extremities and can progress to severe infection and amputation.

According to WHO and various studies, about 10-25% of DM patients are at risk of developing diabetic ulcers during their lifetime, and more than 50% of non-traumatic amputations are caused by this complication. Even after the ulcer heals, the recurrence rate is very high, reaching 66% within five years, and the risk of re-amputation is about 12% (Maigoda, 2022) . The high incidence, morbidity and cost of care resulting from diabetic ulcers suggest that effective, efficient and evidence-based wound care interventions are needed. Over the past few decades, conventional approaches to wound care have evolved towards the principle of Moist Wound Healing (MWH). This principle emphasizes the importance of maintaining moisture in the wound area to accelerate the process of tissue regeneration and prevent excessive scar tissue formation. One type of modern dressing that supports this principle is hydrogel. These dressings are semi-transparent, contain high amounts of water, and function to moisturize the wound, accelerate autolysis of necrotic tissue, and stimulate granulation tissue formation.

Hydrogels have been widely used in various types of wounds, including chronic wounds such as diabetic ulcers. The advantage of hydrogels lies in their ability to maintain an optimal wound environment without irritating the surrounding tissue. In addition, hydrogels are non-adherent, making it easier to change dressings without causing additional pain or trauma to the new tissue. Research by (Handayani, 2016) shows that hydrogel has three times the effectiveness compared to 0.9% NaCl in the wound healing process of diabetic ulcers, based on a significant decrease in wound scores.

In nursing practice, the evidence-based practice approach has become an important foundation to improve the quality of nursing care, including in the management of chronic wounds. One important aspect of hydrogel application is the nurse's ability to systematically assess, intervene and evaluate wound development. The use of tools such as the Bates-Jensen Wound Assessment Tool is very important in measuring the effectiveness of care and determining clinical changes that occur.

However, the application of modern wound care such as hydrogels in Indonesia still faces challenges, especially in rural areas or areas with limited access to health facilities. The low level of knowledge of the public and health workers regarding modern dressing technology is one of the main barriers. Therefore, education, training and dissemination of evidence-based nursing practices are needed to encourage the adoption of modern dressings in chronic wound management. Support from educational institutions and the healthcare system is needed for innovations in wound care to be widely implemented.

In addition to technical and clinical approaches, a holistic perspective also needs serious attention. The holistic nursing approach not only focuses on the physical aspects of the patient, but also considers the psychological, social, cultural and spiritual aspects. In the context of diabetic ulcers, patients not only face physiological disorders, but also emotional stress due to pain, limited mobility, and changes in body image. Therefore, comprehensive psychosocial support is crucial in the healing process.

Spirituality also plays an important role in the patient's recovery process. In the context of Indonesia's religious culture, belief in the power of prayer and hope for healing is an integral part of the treatment journey. In Islamic teachings, for example, there is a strong encouragement to make efforts in curing illness, as stated in QS. Al-Isra: 82 which states that the Qur'an is a healer and a mercy for the believers. This understanding provides additional enthusiasm and motivation for patients to undergo therapy consistently. By considering all aspects above, it can be concluded that the treatment of diabetic ulcers cannot rely solely on conventional therapy. It requires a multidimensional approach that includes modern dressing technology such as hydrogel, evidence-based nursing practice, and a holistic approach that integrates physical, psychological, social and spiritual aspects. Therefore, this study aims to evaluate the effectiveness of wound care implementation using modern hydrogel dressings in patients with diabetic ulcers through a holistic nursing approach.

This study is expected to make a significant scientific contribution to the development of modern nursing practice in Indonesia, as well as encourage the adoption of more effective and patient safety-oriented wound care technology. Furthermore, the results of this study can serve as a reference for health workers in providing quality nursing services, as well as inspire the development of community-based wound care policies.

Objective

The purpose of this study was to evaluate the effectiveness of wound care using modern hydrogel dressings in accelerating diabetic ulcer healing through a holistic nursing care approach.

Method

Design and setting

This study used a descriptive case study design with a qualitative approach. The study was conducted in the patient's home environment located in the Sinar Mawar Neighborhood Hamlet, Cigembor Village, Ciamis District, Ciamis Regency, West Java. The study environment is a community with limited access to health facilities, so the home care approach is the main

choice in providing nursing care. The study subject was a patient with grade 4 diabetic ulcer who met the inclusion criteria based on clinical conditions and family consent.

Population and sampling

The population in this study were patients with diabetic ulcers who underwent wound care in a community or home care environment. The population characteristics that were the focus of the study included individuals with a diagnosis of type 1 diabetes mellitus who had chronic wounds in the lower extremities and met the criteria for moderate to severe diabetic ulcers. The inclusion criteria in this study included patients who were willing to receive home care, were able to communicate well, had diabetic ulcers of grade 4 based on Wagner's classification, and had family consent for the intervention. Meanwhile, the exclusion criteria included patients with severe systemic complications that required intensive care in the hospital or patients who were not cooperative during the treatment process.

The sample in this study was one patient who was purposively selected based on suitability with the research objectives and relevant clinical conditions. The purposive sampling technique was chosen because it allows researchers to select subjects who have specific characteristics according to the focus of the case study. The selected subject was an elderly patient, with a history of DM for more than five years, had a grade 4 diabetic ulcer on the dorsal area of the foot, and showed readiness to undergo modern dressing treatment with hydrogel on an ongoing basis at home.

The sample selection procedure was carried out through an initial identification process by the researcher of several DM patients in the local area. After initial assessment and communication with the family, one patient was selected as meeting all criteria and willing to participate in the full study process. This limited number of samples was adjusted to the descriptive case study design which aims to describe in depth the implementation process of hydrogel wound care holistically in one specific case.

Instrument and measurement

The main instrument used in this study was the *Bates-Jensen Wound Assessment Tool* (BWAT), which is a standardized measurement tool used to evaluate wound conditions systematically and objectively. The BWAT assesses various aspects of the wound such as size, depth, tissue color, exudate, and wound edge condition, with a total score ranging from 13 to 65. The higher the score, the worse the wound condition. The instrument has high reliability and has been widely used in wound nursing practice in various clinical settings.

In addition to the wound assessment, blood sugar levels were measured using a *digital glucometer* to measure GDS as an indicator of the patient's glycemic control during the treatment process. Measurements were taken before and after the hydrogel dressing intervention. Additional data was also collected through direct observation, semi-structured interviews with patients and families, and SOAPIER format-based nursing documentation that supported a thorough and standardized data collection and analysis process.

Data collection and analysis

Data collection was conducted directly in the patient's home over a period of three visits within two weeks. Data collection techniques included direct observation of the wound, semi-structured interviews with the patient and family to understand the physical, psychological and social support conditions, and nursing care documentation using the SOAPIER format. Wound assessment was performed using the Bates-Jensen Wound Assessment Tool (BWAT) at each visit, while blood sugar levels were measured using a digital glucometer at the beginning and end of the intervention period to monitor the patient's glycemic control.

Data were analyzed descriptively qualitatively and quantitatively. Quantitative data from BWAT wound scores and GDS values were analyzed by comparing scores before and after the intervention to see trends in wound condition improvement and glucose control. Meanwhile, qualitative data from interviews and observations were analyzed through data reduction, categorization, and thematic interpretation to obtain a comprehensive understanding of the patient's response to the hydrogel dressing intervention and the effectiveness of a holistic nursing care approach. This analysis aimed to describe changes in the patient's overall condition and identify factors that support the wound healing process.

Result

The results showed changes in wound condition and blood sugar levels after the implementation of wound care using hydrogel dressing.

Figure 1. diabetic ulcer wound

Table 1. Wound Score and Blood Sugar Level (GDS) of Patients

Visit	Wound Score (BWAT)	GDS
Day 1	45	518 mg/dl
Day 2	45	305 mg/dl
Day 3	38	269 mg/dl

During the three visits, the patient's wound score decreased from 45 to 38 based on the Bates-Jensen Wound Assessment Tool. This decrease indicated an improvement in the physical wound condition, including the reduction of slough tissue and the formation of pink granulation tissue. In addition, the patient's blood sugar (GDS) level also decreased from 518 mg/dL at the first visit to 269 mg/dL at the third visit.

Discussion

The results of this study show that the use of modern hydrogel dressings is effective in accelerating wound healing in patients with diabetic ulcers. A decrease in wound score from 45 to 38 showed significant clinical improvement after three visits. The decrease in blood sugar level (GDS) from 518 mg/dL to 269 mg/dL also indicated that the holistic nursing approach supported the overall recovery process.

This finding is in line with research (Handayani, 2016) , which states that hydrogel has three times higher effectiveness than conventional dressings such as NaCl 0.9% in accelerating wound healing. Hydrogel keeps the wound moist, accelerates autolysis of necrotic tissue, and stimulates the formation of healthy granulation tissue. This principle of moist wound healing has been shown to be superior to dry wound care in supporting tissue regeneration.

Decreasing blood glucose levels is also an important supporting factor in the healing process. Chronic hyperglycemia is known to inhibit the immune response, slow tissue repair, and increase the risk of infection. Therefore, glycemic control in conjunction with wound care has a synergistic effect on the success of therapy. The interventions in this study included not only dressing, but also blood glucose monitoring and spiritual support to the patient and family.

A holistic nursing approach adds value to the recovery process. Patients are viewed as whole individuals, with physical, psychological, social, and spiritual dimensions. Spiritual interventions through encouragement to pray, life motivation, and encouragement have been shown to support active patient engagement in care. This approach is in line with the principles of transpersonal and culture-based nursing, which emphasize the importance of respecting patients' values and beliefs.

However, this study has some limitations. The small number of subjects limits the generalizability of the findings. In addition, since a descriptive case study design was used, statistical data showing quantitative significance was not available. Monitoring conducted over only three visits was also insufficient to assess the long-term effects of hydrogel use.
Nevertheless, these results provide a positive initial picture of the potential of hydrogel as a modern dressing in wound care. These findings emphasize the importance of training and education for health workers and families in choosing the right dressing, especially in cases of chronic wounds such as diabetic ulcers. The use of appropriate dressings can accelerate healing, reduce costs, and improve patients' quality of life.

Restate the Key Findings

This study aims to evaluate the effectiveness of using modern hydrogel dressings in accelerating diabetic ulcer wound healing through a holistic nursing care approach. The main result showed a decrease in wound score from 45 to 38 and a decrease in blood glucose level (GDS) from 518 mg/dL to 269 mg/dL after three visits. These findings support the hypothesis that the use of hydrogel can accelerate the healing process of chronic wounds, while demonstrating the benefits of a holistic nursing approach to patient recovery.

This finding is in line with previous research by (Handayani, 2016) , which states that hydrogel dressings provide better results than conventional dressings such as NaCl 0.9% in the

management of diabetic ulcers. Hydrogel dressings work by creating a moist wound environment, accelerating autolysis of necrotic tissue, and stimulating the formation of healthy granulation tissue. This supports the principle of Moist Wound Healing (MWH) which has been shown to be more physiologically effective in promoting tissue regeneration than wound drainage methods.

Interpretation the Results

The findings in this study not only corroborate the clinical effectiveness of hydrogel use in diabetic ulcer healing, but also contribute to the development of wound nursing practice. Biologically, the moisture retained by hydrogels supports fibroblast cell activity, stimulates angiogenesis, and accelerates granulation tissue formation, which plays an important role in the regeneration process of chronic wounds. This differentiates hydrogels from traditional dressings that tend to dry out the wound and inhibit healing.

Clinically, these results emphasize the importance of choosing the right dressing according to the wound condition and patient comfort. Hydrogels are non-adherent, which reduces pain during replacement, which is especially beneficial for elderly patients or those with a low pain threshold. In terms of applicability, hydrogels show potential as an effective alternative treatment for home use. In areas with limited access to healthcare, these dressings allow patients and families to self-treat after adequate education, while reducing long-term medical costs.

Theoretically, these findings support the strengthening of a holistic nursing approach. Wound healing does not only depend on physical aspects, but is also influenced by emotional, social and spiritual factors. In the context of Indonesia's religious society, the integration of spiritual values, such as motivation through prayer and moral support, has been shown to improve patient compliance and morale. This is in line with transpersonal nursing theory that views individuals as multidimensional beings.

Overall, this study adds to the scientific literature on the combined use of modern dressing technology and holistic approaches, and provides a basis for clinical guidelines and evidence-based nursing curriculum development in chronic wound management.

Compare with Previous Studies

The results of this study are in line with previous studies showing that the use of hydrogel dressings is effective in accelerating wound healing of diabetic ulcers. The decrease in wound score from 45 to 38 and the decrease in blood sugar level from 518 mg/dL to 269 mg/dL in three visits showed progress consistent with the findings of (Handayani, 2016) , which stated that hydrogel was three times more effective than 0.9% NaCl dressing.

Comparable results were also seen in a study (Aminuddin et al., 2020) , which highlighted the importance of wound moisture in creating an optimal healing environment, accelerating autolytic debridement, and stimulating granulation tissue formation. (Mahendra, 2022) also stated that hydrogels are effective for chronic wounds due to their non-adherent nature and ability to absorb exudate in a balanced manner.

However, these results differ from the study (Nurcahyani et al., 2018) , which mentioned that significant wound healing with hydrogels usually takes 2-4 weeks. In this study, improvement occurred within two weeks. The difference may be influenced by the severity of the wound, the metabolic condition of the patient, and the active involvement of the family in home care.

In addition, the holistic approach in this study also had a positive influence. Not all previous studies involved educative, psychological and spiritual aspects as applied here. The spiritual approach, which includes the value of faith (QS. Al-Isra: 82), is believed to help increase patient motivation and compliance with the healing process.

Thus, although in line with many previous studies, the holistic approach used in this study is a differentiating factor that accelerates recovery. This confirms the importance of integrating modern technology with psychosocial and educational approaches in chronic wound care.

Highlight the Implications

The findings in this study have a number of important practical, clinical, and theoretical implications that can drive the development of nursing care and the health system as a whole.

1. **Practical Implications**

   The use of modern hydrogel dressings was shown to be effective and applicable in home wound care, especially in areas with limited access to health services. This shows that the patient's family, with the support of trained health workers, is able to carry out wound care independently. Therefore, training in the use of hydrogels should be part of capacity building programs at the primary care level.

2. **Clinical Implications**

   Clinically, hydrogels can be recommended as one of the standards in the management of diabetic ulcers, replacing conventional methods that are less effective. This dressing not only accelerates healing, but also reduces the risk of infection and amputation. A holistic approach that includes emotional and spiritual aspects is proven to accelerate recovery, and can be integrated into a patient-centered care model.

3. **Theoretical Implications and Science Development**

   From a theoretical perspective, the results of this study strengthen the concept of moist wound healing as an effective strategy in healing chronic wounds. In addition, the findings encourage the development of nursing theories that incorporate physical, psychological, social and spiritual dimensions in an integrated manner.

4. **Recommendations for Policy**

   This study supports the need for policies that expand the availability of modern dressings such as hydrogels in primary healthcare facilities. Integration of wound care technology with local and cultural values is also important to be included in nursing education curricula and practice guidelines.

5. **Future Research Directions**

As this study was a single case study, further studies with a quasi-experimental design or randomized controlled trial (RCT) and a larger number of participants are needed. Comparative studies of different types of modern dressings and cost-effectiveness analysis are also important to support wider application in health services.

Discuss the Limitations

This study has limitations that need to be considered in assessing the strength of the results. First, the single-case study design means that the findings cannot be generalized to a wider population. Second, the absence of a control group makes it difficult to determine whether wound improvement was entirely due to the use of hydrogel or influenced by other factors such as blood sugar control and family support.

In addition, the short duration of the intervention (three visits in one week) limited the evaluation of long-term effectiveness. Wound condition assessment was conducted by only one researcher without inter-rater validation, which risks subjective bias. The social and geographical conditions of the patients were also specific, so the results may not be relevant in different contexts.

Nevertheless, this study still provides a meaningful initial contribution in assessing the effectiveness of hydrogel as a modern dressing in a holistic nursing approach. Further research with a quasi-experimental design and a larger number of respondents is highly recommended to strengthen the scientific evidence.

Suggest Future Research

Based on the findings and limitations of this study, it is recommended that future research use a quantitative or quasi-experimental design with a larger number of respondents and involve a control group. This approach is important to strengthen the scientific evidence regarding the effectiveness of hydrogels in the treatment of diabetic ulcers and increase the external validity of the study results.

Long-term monitoring is also needed to assess the sustainability of wound healing, including the potential for recurrence, the rate of tissue regeneration, and the risk of complications after therapy.

Future researchers are expected to include objective measurements of patients' psychological, spiritual and quality of life aspects using standardized instruments. This is important to assess the overall impact of the holistic approach, including its effect on patient compliance.

In addition, comparative studies between different types of modern dressings (e.g. hydrogel, hydrocolloid and foam dressing) are needed to determine the most effective and efficient option for chronic wound management.

Finally, a cost-benefit analysis of hydrogel use in primary care and home care should also be conducted as a basis for formulating more cost-effective and applicable policies for the wider community.

Conclusion

This study shows that the use of modern hydrogel dressings is effective in accelerating the wound healing process of diabetic ulcers, as shown by a significant decrease in wound scores and blood sugar levels in a short period of time. The application of a holistic nursing approach that includes physical, psychological, social, and spiritual aspects contributed to the overall success of the therapy. These findings reinforce the importance of appropriate dressing selection and integration of a holistic approach in nursing practice. Therefore, the use of hydrogel can be recommended as one of the options in evidence-based chronic wound management, especially in primary health care and home care.

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Author Contribution

All stages of this research were carried out under the responsibility of the authors. Salsya Haerani acted as the main author who collected data, provided education to patients, analyzed the results, and compiled reports and scientific articles. Ade Fitriani, acted as a supervisor by providing methodological guidance, validating the content of the study, as well as conducting critical reviews and editing the final manuscript. Both authors contributed actively in every process, from the implementation of the research to the preparation of the publication manuscript.

Conflict of Interest

The authors declare that there are no financial, personal, or professional conflicts of interest that could influence the results or interpretations of this study.

Ethical Clearance

This study has obtained approval from the Health Research Ethics Committee of the Muhammadiyah Ciamis College of Health Sciences. All procedures were carried out by upholding the principles of research ethics, including obtaining informed consent, maintaining the confidentiality of subjects' personal data, and ensuring that there were no adverse risks to participants.

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