

Comparative Evaluation of Topical Diperoxochloric Acid and Normal Saline Dressings in the Management of Diabetic Foot Ulcers

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ABSTRACT

Background: Diabetic foot ulcers are a major complication of diabetes mellitus, associated with significant morbidity and risk of amputation. Effective wound management is essential to promote healing and prevent complications. While normal saline is commonly used for wound care, newer agents such as diperoxochloric acid may offer improved outcomes due to their antimicrobial properties.

Aim: To compare the effectiveness of topical diperoxochloric acid and normal saline dressings in the management of diabetic foot ulcers.

Materials and Methods: This hospital-based observational study was conducted at Meenakshi Medical College Hospital, Kanchipuram, over one year. A total of 60 patients with diabetic foot ulcers were included and managed either with diperoxochloric acid dressing (n = 30) or normal saline dressing (n = 30). Outcomes assessed included reduction in ulcer size, time to granulation tissue formation, duration of healing, infection control, and need for surgical intervention. Statistical analysis was performed using SPSS, and a p value < 0.05 was considered statistically significant.

Results: Patients treated with diperoxochloric acid showed significantly greater reduction in ulcer size (p = 0.001), earlier granulation tissue formation (p = 0.001), and shorter healing time (p = 0.001) compared to the normal saline group. Infection resolution was higher in the diperoxochloric acid group (86.7% vs 60%; p = 0.02). The need for surgical intervention was significantly lower (p = 0.04).

Conclusion: Topical diperoxochloric acid is more effective than normal saline dressing in promoting wound healing and infection control in diabetic foot ulcers.

Keywords: Diabetic foot ulcer, diperoxochloric acid, normal saline dressing, wound healing, infection control, observational study

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Introduction

Diabetic foot ulcers are a major complication of diabetes mellitus and represent a significant cause of morbidity, hospitalization, and lower limb amputation worldwide. They result from a combination of peripheral neuropathy, peripheral vascular disease, and infection, leading to impaired wound healing. Effective management of diabetic foot ulcers is essential to reduce complications and improve patient outcomes [1].

Wound care plays a critical role in the management of diabetic foot ulcers. The primary goals of wound care include infection control, promotion of granulation tissue, and facilitation of wound healing. Various topical agents and dressing techniques have been used to achieve these objectives, ranging from conventional saline dressings to advanced antimicrobial agents [2]. Normal saline is widely used as a standard wound cleansing agent due to its isotonic nature, low cost, and minimal tissue irritation. However, it lacks

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antimicrobial properties and may not be sufficient in managing infected or non-healing wounds [3].

Diperoxochloric acid is a newer topical agent with strong antimicrobial properties. It acts by releasing reactive oxygen species that disrupt microbial cell membranes, thereby reducing bacterial load. In addition to its antimicrobial effects, it is believed to promote wound healing by enhancing tissue oxygenation and reducing inflammation [4].

Several studies have evaluated the effectiveness of different wound care modalities in diabetic foot ulcers. While conventional dressings such as normal saline are simple and cost-effective, advanced agents like diperoxochloric acid may offer improved outcomes in terms of faster healing and reduced infection rates. However, the evidence comparing these two modalities remains limited [5–6].

The management of diabetic foot ulcers requires a balance between effectiveness, cost, and patient compliance. Identifying an optimal dressing method that enhances healing while minimizing complications is essential for improving clinical outcomes [7].

In routine clinical practice, treatment selection is often based on availability and clinical judgment rather than controlled allocation. Therefore, observational studies provide valuable insights into the real-world effectiveness of different wound care strategies.

Hence, the present study was undertaken to compare the effectiveness of topical diperoxochloric acid and normal saline dressings in the management of diabetic foot ulcers in an observational study setting.

Materials and Methods

This hospital-based observational study was conducted in the Department of General Surgery at Meenakshi Medical College Hospital and Research Institute, Kanchipuram, Tamil Nadu, over a period of one year. The study aimed to compare the effectiveness of topical diperoxochloric acid and normal saline dressings in the management of diabetic foot ulcers.

A total of 60 patients diagnosed with diabetic foot ulcers were included in the study. Patients aged 18 years and above with clinically diagnosed diabetic foot ulcers of Wagner grade I and II were considered eligible. Patients with advanced ulcers (Wagner grade III and above), osteomyelitis, severe peripheral arterial disease, uncontrolled diabetes, or those unwilling to participate were excluded from the study.

All patients underwent detailed clinical evaluation including history taking, physical examination, and relevant laboratory investigations. Baseline assessment of the ulcer included size, depth, presence of infection, and duration of ulcer.

Based on routine clinical practice and availability of treatment, patients were managed either with topical diperoxochloric acid dressing (Group A) or normal saline dressing (Group B). No randomization was performed as this was an observational study.

In Group A, wounds were cleaned and dressed with topical diperoxochloric acid solution, while in Group B, wounds were dressed using normal saline-soaked gauze. Dressings were performed regularly under aseptic precautions. All patients received standard diabetic care including glycemic control, antibiotics when indicated, and appropriate offloading measures.

Outcome measures assessed included reduction in ulcer size, time to appearance of healthy granulation tissue, duration of healing, infection control, and need for surgical intervention. Patients were followed up at regular intervals to assess wound progression.

All data collected during the study were systematically entered into Microsoft Excel and subsequently analyzed using Statistical Package for the Social Sciences (SPSS) software. Descriptive statistics including mean, standard deviation, frequencies, and percentages were used to summarize the variables. Comparative analysis between groups was performed using the independent t test for continuous variables and the Chi square test for categorical variables. A p value of less than 0.05 was considered statistically significant.

Results

A total of 60 patients with diabetic foot ulcers were included in the study, with 30 patients in the diperoxochloric acid group and 30 patients in the normal saline dressing group.

Table 1: Demographic Characteristics of Study Participants (n = 60)

Variable	Diperoxochloric Acid (n = 30)	Normal Saline (n = 30)	p value
Mean age (years)	52.6 ± 9.4	51.8 ± 10.1	0.74
Male	18 (60%)	17 (56.7%)	0.79
Female	12 (40%)	13 (43.3%)	

The mean age and gender distribution were comparable between both groups. The differences were not statistically significant ($p = 0.74$ and $p = 0.79$), indicating that both groups were similar at baseline.

Table 2: Reduction in Ulcer Size (cm²)

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Parameter	Diperoxochloric Acid	Normal Saline	p value
Initial ulcer size	6.8 ± 2.1	6.5 ± 2.3	0.63
Final ulcer size	2.1 ± 1.4	3.8 ± 1.9	0.001

Both groups showed reduction in ulcer size; however, the reduction was significantly greater in the diperoxochloric acid group. The difference in final ulcer size was statistically significant ($p = 0.001$), indicating better wound healing with diperoxochloric acid.

Table 3: Time to Appearance of Granulation Tissue

Parameter	Diperoxochloric Acid	Normal Saline	p value
Mean days	6.4 ± 2.2	10.2 ± 3.1	0.001

The mean time for appearance of healthy granulation tissue was significantly shorter in the diperoxochloric acid group compared to the normal saline group. This difference was statistically significant ($p = 0.001$), indicating faster wound healing initiation.

Table 4: Duration of Complete Healing

Parameter	Diperoxochloric Acid	Normal Saline	p value
Mean healing time (days)	18.6 ± 4.8	26.4 ± 6.2	0.001

Patients treated with diperoxochloric acid showed significantly faster complete healing compared to those treated with normal saline. The difference was statistically significant ($p = 0.001$).

Table 5: Infection Control

Outcome	Diperoxochloric Acid	Normal Saline	p value
Infection resolved	26 (86.7%)	18 (60%)	0.02
Persistent infection	4 (13.3%)	12 (40%)	

A significantly higher proportion of patients in the diperoxochloric acid group showed resolution of infection compared to the normal saline group. This difference was statistically significant ($p = 0.02$), indicating better antimicrobial effectiveness.

Table 6: Need for Surgical Intervention

Parameter	Diperoxochloric Acid	Normal Saline	p value
Required debridement/amputation	3 (10%)	9 (30%)	0.04
No surgical intervention	27 (90%)	21 (70%)	

The need for surgical intervention was significantly lower in the diperoxochloric acid group compared to the normal saline group. This difference was statistically significant ($p = 0.04$), suggesting improved clinical outcomes with diperoxochloric acid dressing.

Discussion

The present observational study compared the effectiveness of topical diperoxochloric acid and normal saline dressings in the management of diabetic foot ulcers. The findings demonstrated that diperoxochloric acid dressing was associated with faster wound healing, better infection control, and reduced need for surgical intervention compared to conventional saline dressings.

In the present study, baseline characteristics such as age and gender distribution were comparable between the two groups ($p = 0.74$ and $p = 0.79$), indicating homogeneity of the study population. Similar findings were reported by Armstrong DG et al [8], who emphasized the importance of comparable baseline characteristics in wound healing studies.

The reduction in ulcer size was significantly greater in the diperoxochloric acid group, with final ulcer size measuring $2.1 \pm 1.4 \text{ cm}^2$ compared to $3.8 \pm 1.9 \text{ cm}^2$ in the normal saline group ($p = 0.001$). This finding is consistent with Lipsky BA et al [9], who reported that advanced wound care agents contribute to enhanced wound contraction and healing.

The time to appearance of healthy granulation tissue was significantly shorter in the diperoxochloric acid group (6.4 ± 2.2 days) compared to the normal saline group (10.2 ± 3.1 days), with a statistically significant difference ($p = 0.001$). Similar observations were reported by Game FL et al [10], who highlighted that antimicrobial dressings promote early granulation and wound healing.

The duration of complete healing was also significantly reduced in the diperoxochloric acid group (18.6 ± 4.8 days vs 26.4 ± 6.2 days; $p = 0.001$). This finding aligns with Jeffcoate WJ et al [11], who emphasized that effective wound management strategies can significantly reduce healing time in diabetic foot ulcers.

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In terms of infection control, a significantly higher proportion of patients in the diperoxochloric acid group showed resolution of infection (86.7% vs 60%; $p = 0.02$). This may be attributed to the strong antimicrobial properties of diperoxochloric acid. Similar findings were reported by Lavery LA et al [12], who demonstrated improved infection control with advanced antimicrobial agents.

The need for surgical intervention was significantly lower in the diperoxochloric acid group (10% vs 30%; $p = 0.04$), indicating better overall clinical outcomes. This finding is supported by Prompers L et al [13], who reported that effective wound care reduces the need for surgical procedures and amputation.

Normal saline, although widely used, lacks antimicrobial properties and may not be sufficient in managing infected wounds. Edmonds M et al [14] highlighted that while saline is useful for wound cleansing, it does not actively promote healing or infection control.

Advanced wound care modalities have been increasingly recommended in the management of diabetic foot ulcers. Hinchliffe RJ et al [15] emphasized the importance of selecting appropriate topical agents to enhance healing and reduce complications.

Recent studies have also highlighted the role of antimicrobial agents in improving outcomes. Lipsky BA et al [16] reported that targeted antimicrobial therapy plays a crucial role in reducing infection and promoting wound healing in diabetic foot ulcers.

Overall, the findings of the present study suggest that diperoxochloric acid is more effective than normal saline dressing in promoting wound healing, controlling infection, and reducing complications. Its use may improve clinical outcomes and reduce the burden of diabetic foot ulcers.

Conclusion

The present observational study demonstrated that topical diperoxochloric acid dressing is more effective than normal saline dressing in the management of diabetic foot ulcers. Patients treated with diperoxochloric acid showed significantly greater reduction in ulcer size, faster appearance of granulation tissue ($p = 0.001$), shorter duration of healing ($p = 0.001$), and better infection control ($p = 0.02$). Additionally, the need for surgical intervention was significantly lower in this group ($p = 0.04$). Although both dressing methods are safe and commonly used, diperoxochloric acid offers superior clinical outcomes and may be considered a more effective option in the management of diabetic foot ulcers.

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