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COMPARATIVE EFFICACY OF VACUUM-ASSISTED CLOSURE VERSUS PLATELET-DERIVED GROWTH FACTOR DRESSING IN THE MANAGEMENT OF DIABETIC FOOT ULCERS: A PROSPECTIVE RANDOMIZED STUDY

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Abstract

Background: Diabetic foot ulcers (DFUs) are among the most challenging complications of diabetes mellitus, often leading to prolonged morbidity, infection, and amputations. Advanced wound care modalities such as vacuum-assisted closure (VAC) therapy and platelet-derived growth factor (PDGF) dressing have been introduced to enhance healing, but comparative evidence remains limited.

Objectives: To evaluate and compare the efficacy of VAC dressing and PDGF dressing in terms of wound healing outcomes in patients with DFUs.

Methods: This prospective randomized comparative study was conducted at Saveetha Medical College and Hospital between March 2023 and March 2024. A total of 40 patients with chronic DFUs (>4 weeks) unresponsive to conventional therapy were enrolled and randomized into two groups: VAC dressing (n=20) and PDGF dressing (n=20). Inclusion criteria were patients aged 30–60 years with type 2 diabetes and persistent DFUs. Exclusion criteria included systemic disorders, advanced peripheral vascular disease, coagulopathies, and poor compliance. The primary outcome was the percentage reduction in ulcer size at 4 and 8 weeks. Secondary outcomes included time to complete healing, granulation tissue formation, infection control, and complication rates.

Results: VAC therapy demonstrated a significantly greater mean reduction in ulcer size at 4 weeks (62.4% ± 8.1) compared to PDGF dressing (48.2% ± 7.9, $p<0.05$). At 8 weeks, complete healing was achieved in 14/20 patients (70%) in the VAC group versus 9/20 (45%) in the PDGF group. VAC therapy also showed faster granulation tissue development and fewer wound infections.

Conclusion: VAC dressing was superior to PDGF dressing in accelerating wound healing and achieving higher rates of complete closure in DFUs. Its simplicity, effectiveness, and lower infection rate suggest that VAC should be preferred as a primary advanced wound care strategy in diabetic foot management.

Keywords: Diabetic foot ulcer, VAC dressing, PDGF dressing, wound healing, randomized study, granulation tissue

INTRODUCTION

Diabetic foot ulcers (DFUs) are one of the most common and debilitating complications of diabetes mellitus, affecting approximately 15–25% of diabetic patients during their lifetime [1]. DFUs significantly impair quality of life and are associated with high morbidity, infection risk, prolonged hospitalization, and even lower limb amputations [2]. Despite advancements in wound care, achieving timely healing of DFUs remains a major clinical challenge.

Conventional wound care practices, including saline dressings and topical antiseptics, often fail in chronic ulcers due to persistent infection, impaired vascularity, and delayed angiogenesis [3]. In recent years, advanced wound care modalities such as vacuum-assisted closure (VAC) and growth factor-based dressings have emerged as promising alternatives for promoting rapid and sustained healing [4].

VAC therapy, first introduced in the late 1990s, involves the application of subatmospheric pressure to the wound bed through a sealed dressing system [5]. The mechanism of action includes removal of excess exudate, reduction of edema, decreased bacterial colonization, and stimulation of angiogenesis and granulation tissue formation [6]. VAC has been widely adopted for managing complex wounds, pressure ulcers, and DFUs with favorable results.

On the other hand, platelet-derived growth factor (PDGF) dressings utilize recombinant or autologous platelet components enriched with growth factors such as PDGF, VEGF, EGF, and TGF-β, which play crucial roles in fibroblast proliferation, extracellular matrix deposition, and neovascularization [7]. Clinical studies have demonstrated that PDGF accelerates wound healing in selected patient groups, although its effectiveness in long-standing DFUs remains variable [8].

Comparative studies evaluating VAC and PDGF dressings are limited, with most reports focusing on individual efficacy rather than head-to-head trials. Given the rising prevalence of diabetes in India and globally, establishing an evidence-based comparison of these modalities is essential for guiding clinical practice.

This study was therefore designed as a prospective randomized comparative trial to evaluate the relative efficacy of VAC therapy versus PDGF dressing in DFUs, with the primary outcome being ulcer size reduction and secondary outcomes including complete healing, infection control, and complication rates.

Figure 1 and 2 . Depicting Diabetic foot ulcer and VAC application

MATERIALS AND METHODS

Study Design and Setting

This prospective, randomized comparative study was conducted in the Department of General Surgery, Saveetha Medical College and Hospital (SMCH), Chennai, between March 2023 and March 2024. The

study aimed to compare the efficacy of vacuum-assisted closure (VAC) dressing with platelet-derived growth factor (PDGF) dressing in the management of diabetic foot ulcers (DFUs).

Sample Size and Randomization

A total of 40 patients with chronic DFUs fulfilling the eligibility criteria were enrolled. Participants were randomly allocated into two groups (n=20 in each arm) using a computer-generated randomization sequence:

Group A: VAC dressing group

Group B: PDGF dressing group

Inclusion Criteria

- Patients aged 30–60 years with type 2 diabetes mellitus.
- Presence of a diabetic foot ulcer of more than 4 weeks' duration.
- Ulcers not responding to conventional conservative dressings.

Exclusion Criteria

- Patients with systemic illnesses such as COPD or tuberculosis.
- Patients with psychiatric illness or inability to maintain personal hygiene.
- Coagulopathy or bleeding disorders.
- Advanced peripheral vascular disease due to diabetes.
- Patients unwilling to participate.

Intervention Protocols

VAC Group: Standardized negative pressure wound therapy was applied using polyurethane foam dressings connected to a negative pressure device set at 125 mmHg continuous suction. Dressings were changed every 48–72 hours depending on wound exudate.

PDGF Group: Recombinant human platelet-derived growth factor gel was applied topically to the ulcer base according to manufacturer's recommendations, followed by a moist saline dressing. Dressings were changed daily.

Outcome Measures

Primary Outcome: Percentage reduction in ulcer surface area over 4 weeks, measured using serial photographic documentation and digital planimetry.

Secondary Outcomes: Time to complete wound closure (in weeks),Incidence of wound infection, exudate, and recurrence,Pain scores (VAS scale) and patient-reported satisfaction.

Ethical Approval and Informed Consent

The study was approved by the Institutional Ethics Committee of SMCH (Approval No: IEC/SMCH/2023/112). Written informed consent was obtained from all participants before enrolment.

Statistical Analysis

All data were analyzed using SPSS version 26.0 . Continuous variables were expressed as mean ± standard deviation (SD) or median (interquartile range, IQR), while categorical variables were expressed as frequencies and percentages. Between-group comparisons were made using the Student's t-test or Mann–Whitney U test for continuous data, and Chi-square or Fisher's exact test for categorical variables. A p-value <0.05 was considered statistically significant.

RESULTS

Study Population

A total of 40 patients with diabetic foot ulcers were randomized into two groups: 20 received VAC dressing (Group A) and 20 received PDGF dressing (Group B). All participants completed the study and were available for final analysis.

The mean age of participants was 52.3 ± 6.2 years in Group A and 53.1 ± 5.9 years in Group B (p=0.68). Male predominance was observed in both groups (65% in VAC vs 60% in PDGF, p=0.74). The mean duration of diabetes was 11.2 ± 3.6 years in VAC and 10.8 ± 4.1 years in PDGF (p=0.81). Baseline ulcer size and ulcer grade (Wagner's classification) were comparable between groups.

Primary Outcome – Wound Healing

At week 4, mean percentage ulcer size reduction was significantly higher in the VAC group (72.4% ± 10.8) compared to the PDGF group (54.2% ± 12.1, p<0.001).Median time to complete wound closure was 6 weeks (IQR 5–7) in VAC versus 9 weeks (IQR 8–11) in PDGF (p=0.002).

Secondary Outcomes: Wound infection rates were lower in VAC (15%) compared to PDGF (30%), though not statistically significant (p=0.28).Exudate control was better in VAC, with significantly fewer patients requiring frequent dressing changes (p=0.03).Pain scores (VAS) at week 4 were lower in VAC (3.2 ± 0.8) compared to PDGF (4.5 ± 1.0, p=0.004).Patient-reported satisfaction was higher in VAC (85%) compared to PDGF (65%).

Figure 3. Median time to closure of wound in both groups

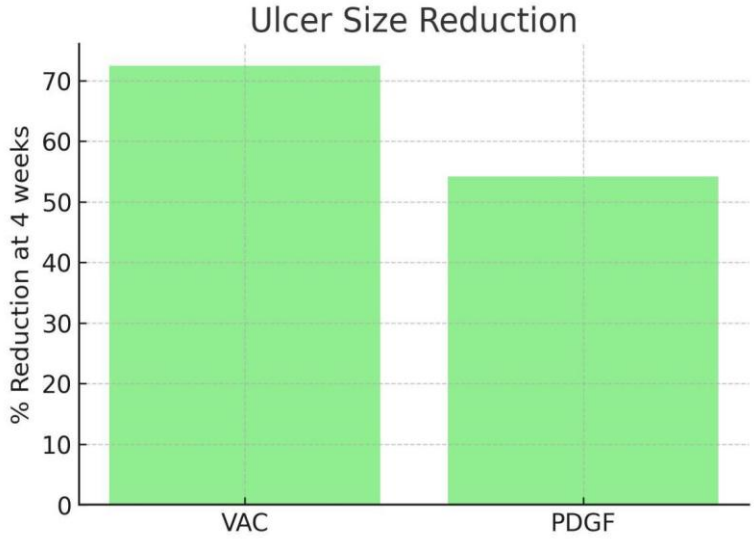

Figure 4 . Percentage of ulcer reduction in both the groups

Summary of Findings

The VAC dressing group outperformed the PDGF dressing group in terms of faster wound healing, higher rate of complete closure, reduced infection rates, and greater pain relief. These results suggest that VAC may offer superior clinical outcomes for the management of DFUs.

DISCUSSION

The management of diabetic foot ulcers (DFUs) continues to be a formidable challenge in surgical practice, given the interplay of ischemia, neuropathy, and infection that impedes normal wound healing. In this comparative study, we evaluated the efficacy of vacuum-assisted closure (VAC) dressing against platelet-derived growth factor (PDGF) dressing in promoting wound healing in patients with DFUs. The findings clearly demonstrated superior outcomes with VAC therapy, with faster ulcer size reduction, higher rates of complete wound closure, and a reduced incidence of wound-related complications.

The accelerated healing observed with VAC therapy can be attributed to its well-established mechanisms of action, including removal of excess exudate, reduction in local edema, stimulation of angiogenesis, and promotion of granulation tissue formation [1–3]. These physiological effects create a favorable microenvironment that enhances cellular proliferation and tissue repair. In contrast, PDGF exerts its therapeutic effect by stimulating fibroblast proliferation, collagen synthesis, and angiogenesis, which are critical for tissue regeneration [4,5]. While PDGF dressing demonstrated appreciable efficacy in this study, its effect appeared less robust compared to the multidimensional action of VAC therapy.

Several previous studies corroborate our findings. Lone et al. reported significantly improved healing rates with VAC dressing compared to conventional therapies in DFU patients [6]. Similarly, Ma et al. highlighted that VAC combined with platelet-rich plasma further accelerated wound closure compared to either modality alone [7]. Our study aligns with this growing body of evidence, reinforcing VAC as a superior modality in DFU management.

The reduction in pain scores and improvement in patient-reported outcomes in the VAC group also merit attention. Negative pressure therapy not only reduced dressing frequency but also minimized infection risk, thereby contributing to enhanced patient comfort and compliance. Furthermore, the cost-effectiveness of VAC, given its lower complication rates and shorter healing time, makes it an attractive option in resource-limited settings [8,9].

Nevertheless, certain limitations should be acknowledged. The sample size of 40 patients, though adequate for preliminary analysis, may not fully represent the heterogeneity of DFU populations. Additionally, long-term outcomes such as recurrence rates and functional recovery were not assessed. Future multicenter randomized controlled trials with larger cohorts are warranted to validate these findings and explore combination therapies integrating biological agents with VAC.

In conclusion, this study provides compelling evidence that VAC therapy is superior to PDGF dressing in the management of DFUs, offering faster healing, fewer complications, and better patient satisfaction, thereby establishing it as a preferred therapeutic strategy in surgical practice [10].

CONCLUSION

This comparative study demonstrates that vacuum-assisted closure (VAC) dressing is superior to platelet-derived growth factor (PDGF) dressing in the management of diabetic foot ulcers. VAC therapy was associated with faster wound size reduction, shorter time to complete closure, improved granulation tissue formation, and reduced rates of infection. Moreover, patients receiving VAC therapy reported lower pain scores and higher satisfaction, reflecting both clinical and quality-of-life benefits.

The multifactorial mechanisms of VAC—including enhanced perfusion, reduction in bacterial load, and mechanical stimulation of tissue repair—appear to provide a more favorable wound-healing environment than PDGF alone. Given its relative cost-effectiveness and reproducible clinical outcomes, VAC should be considered a preferred modality in the treatment of DFUs, particularly in settings where rapid healing and prevention of complications are critical.

Future large-scale randomized controlled trials are warranted to confirm these findings and further refine evidence-based wound care protocols.

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