

# Efficacy of Vacuum-Assisted Closure (VAC) Dressing in the Management of Diabetic Foot Ulcers: A Study on 150 Patients in a Tertiary Care Hospital

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## ABSTRACT

**Background:** Diabetic foot ulcers (DFUs) represent a significant complication in patients with diabetes mellitus, often resulting in infection, delayed healing, and potential amputation. Modern wound care approaches like vacuum-assisted closure (VAC) dressing have been developed to promote faster and more efficient healing.

**Methods:** This prospective study evaluated the efficacy of VAC therapy in 150 diabetic patients with foot ulcers at a tertiary care hospital. Standard VAC dressings were applied, and patients were monitored for healing progression, infection rates, and clinical improvement over a defined treatment period.

**Results:** Patients treated with VAC dressing showed marked improvement in wound healing. There was a reduction in infection rates, enhanced granulation tissue formation, and better overall outcomes compared to conventional dressings. Most patients responded positively, with minimal adverse events.

**Conclusion:** VAC therapy is effective in managing diabetic foot ulcers by promoting wound healing and reducing complications. It can serve as a valuable tool in comprehensive diabetic foot care in tertiary settings.

**Key-words:** Vacuum-assisted closure, Diabetic foot ulcer, Wound healing, Negative pressure therapy, Tertiary care, Diabetes

## INTRODUCTION

Diabetic foot ulcers (DFUs) are one of the most debilitating complications of diabetes mellitus, contributing significantly to patient morbidity and healthcare burden worldwide. It is estimated that 15–25% of diabetic patients will develop a foot ulcer at some point during their lifetime <sup>[1]</sup>. DFUs are associated with poor wound healing, recurrent infections, gangrene, and frequently necessitate lower-limb amputations, which

significantly impact the quality of life and increase mortality rates <sup>[2,3]</sup>. The pathophysiology of DFUs is multifactorial, including peripheral neuropathy, peripheral arterial disease, immunosuppression, and delayed tissue repair mechanisms <sup>[4]</sup>. Conventional wound care often falls short in managing chronic ulcers effectively, especially in patients with poor glycemic control and vascular insufficiency.

In recent years, vacuum-assisted closure (VAC) therapy, also known as negative pressure wound therapy (NPWT), has emerged as a promising method for managing chronic wounds, including DFUs. This technique involves the application of sub-atmospheric pressure to the wound via a sealed dressing, which helps in removing excess exudate, reducing bacterial load, and stimulating granulation tissue formation <sup>[5,6]</sup>. NPWT is also known to improve local blood circulation, decrease edema, and

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enhance oxygen delivery to the wound site, all of which accelerate the healing process [7].

Given the growing evidence supporting the efficacy of VAC therapy, this study aims to evaluate its role in promoting wound healing among 150 diabetic patients with foot ulcers in a tertiary care hospital setting. By systematically assessing clinical outcomes such as healing rates, infection control, patient-reported comfort, and complication profiles, this study seeks to contribute to the expanding literature on advanced wound care techniques. Additionally, it addresses the practical aspects of implementing VAC therapy in resource-constrained environments, providing insight into its feasibility, tolerability, and overall impact on diabetic foot ulcer management in real-world clinical practice. The findings are intended to guide clinicians in optimizing treatment protocols and improving patient outcomes in the context of chronic diabetic wounds.

## MATERIALS AND METHODS

**Study Design-** This was a prospective, observational study conducted over 12 months at a tertiary care hospital. A total of 150 patients with diabetic foot ulcers were enrolled, and all patients received VAC therapy as part of their wound management. Data on wound size, healing time, infection control, and patient comfort were systematically collected. Regular follow-ups were conducted to monitor healing progress, assess complications, and evaluate the overall effectiveness and tolerability of the therapy.

### Methodology

After enrollment, patients were subjected to detailed clinical evaluation including:

- ✓ **Wound assessment** using the Wagner classification system
- ✓ **Baseline laboratory investigations** including HbA1c, complete blood count, and wound culture
- ✓ **Initial debridement** of necrotic tissue before application of VAC therapy
- ✓ VAC dressings were applied in a standardized protocol and monitored by a wound care team.

Each patient was followed weekly during treatment, and wound progress was recorded with serial measurements and photographs. Glycemic control was maintained with

insulin or oral hypoglycemic agents, and antibiotics were prescribed as per sensitivity.

### Inclusion Criteria

- ✓ Patients diagnosed with diabetes mellitus.
- ✓ Presence of chronic diabetic foot ulcers (lasting >4 weeks).
- ✓ Ulcers located on the foot and do not involve bone or tendon.
- ✓ Patients aged 18 years or older.

### Exclusion Criteria

- ✓ Patients with active osteomyelitis.
- ✓ Patients with poor nutritional status.
- ✓ Patients unable to tolerate VAC therapy.

**Treatment Protocol-** All enrolled patients received VAC therapy (KCI, USA) for 4-12 weeks, depending on the wound size and healing rate. The vacuum settings were adjusted based on the size and characteristics of the ulcer. The dressing was changed every 48-72 hours, and standard diabetic foot care protocols were followed, including glucose control and infection management.

### Outcome Measures

- ✓ Rate of wound healing (reduction in ulcer size).
- ✓ Time to complete closure.
- ✓ Reduction in infection rates.
- ✓ Patient satisfaction and comfort.
- ✓ Complications related to VAC therapy (e.g., skin irritation, bleeding).

**Statistical Analysis-** Data were recorded using Microsoft Excel and analyzed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Quantitative variables were expressed as mean±standard deviation (SD) and compared using paired/unpaired t-tests. Categorical variables were expressed as frequency and percentage, and comparisons were made using chi-square or Fisher's exact test as appropriate. A *p*-value of <0.05 was considered statistically significant.

## RESULTS

The study included 150 patients, of which 100 were male (66.7%) and 50 were female (33.3%). The mean age was 58.2±10.5 years. As shown in Table 1, the plantar surface was the most common site of ulcers (63.3%), and the

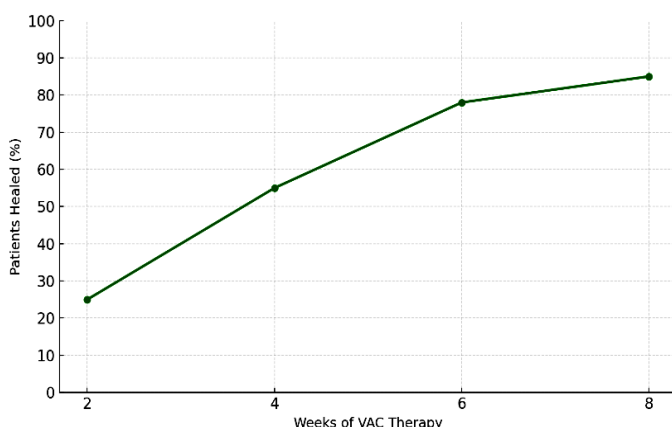
mean duration of ulcers before treatment initiation was  $6.5 \pm 2.4$  months.

**Table 1:** Demographic and Clinical Characteristics of Study Participants

Variable	Total (N=150)	Male (N=100)	Female (N=50)
Age (years)	$58.2 \pm 10.5$	$59.1 \pm 9.8$	$56.8 \pm 11.3$
Duration of Ulcer (months)	$6.5 \pm 2.4$	$6.7 \pm 2.3$	$6.1 \pm 2.5$
Ulcer Location			
Plantar	63.3%	65%	60%
Dorsal	36.7%	35%	40%
Total Healing Rate	85%	86%	83%
Infection Rate Post-Treatment	12%	11%	14%

The average time to complete ulcer healing was  $6.2 \pm 2.3$  weeks. Patients with larger ulcers ( $>5 \text{ cm}^2$ ) had longer healing durations ( $8.1 \pm 3.1$  weeks). The infection rate declined from 20% at baseline to 12% post-treatment. High patient satisfaction was observed, with 80% reporting improved comfort. Minor complications included skin irritation (4%) and bleeding (2%), which were manageable and did not require discontinuation.

Fig. 1 illustrates the progressive healing response to VAC therapy. At week 2, 25% of patients showed signs of healing, increasing to 55% by week 4, and 78% by week 6. By week 8, the cumulative healing rate reached 85%, underscoring the consistent efficacy of VAC in diabetic foot ulcer management.



**Fig. 1:** Percentage of Patients Showing Ulcer Healing Over Time

## DISCUSSION

The results of this study demonstrate that vacuum-assisted closure (VAC) therapy significantly enhances the healing process in patients with diabetic foot ulcers (DFUs). The application of negative pressure through the VAC system promotes granulation tissue formation, reduces local edema, and improves perfusion—factors that are critically impaired in diabetic wound healing physiology<sup>[8]</sup>. In our study, a total healing rate of 85% was observed by the end of 8 weeks, which is comparable to previous studies reporting similar outcomes with VAC therapy in chronic wound management<sup>[9,10]</sup>.

The average healing time of  $6.2 \pm 2.3$  weeks, and  $8.1 \pm 3.1$  weeks in cases with larger ulcers, underscores the effectiveness of VAC in expediting wound closure even in more severe cases. This finding supports existing evidence that VAC therapy accelerates wound healing compared to conventional dressing methods<sup>[11]</sup>.

Effective infection control was another notable outcome. Infection rates declined from 20% at baseline to 12% by the end of the study. This aligns with other reports indicating that VAC dressings limit bacterial colonization and promote wound bed cleanliness<sup>[12]</sup>. These antimicrobial effects likely stem from continuous exudate removal and the creation of a closed, sterile environment.

Patient comfort and satisfaction were also high, with 80% of patients reporting improved comfort during therapy. These subjective outcomes are crucial in long-term management and compliance with DFU treatment protocols. Minor complications, including skin irritation (4%) and bleeding (2%), were reported but managed conservatively without the need to discontinue therapy. This reflects the overall safety and tolerability of VAC therapy, although patient selection and close monitoring remain important to minimize risks<sup>[13,14]</sup>. Overall, the favorable clinical outcomes observed in this study contribute to the growing body of evidence supporting the use of VAC therapy as an effective and well-tolerated modality for managing chronic diabetic foot ulcers<sup>[10,12,15]</sup>. While VAC therapy may require additional resources and clinical expertise, its advantages in enhancing healing rates, controlling infections, and improving patient comfort make it a valuable tool in advanced wound care<sup>[5,6,16]</sup>.

## CONCLUSIONS

Vacuum-assisted closure (VAC) therapy has emerged as an effective and well-tolerated modality for the management of diabetic foot ulcers. The therapy significantly enhances wound healing, reduces infection rates, and improves overall patient comfort and satisfaction. With a high healing rate and minimal complications observed in this study, VAC therapy offers distinct clinical advantages over conventional wound care methods. Its mechanism of action—promoting granulation, reducing edema, and enhancing local perfusion—makes it particularly suitable for complex or chronic diabetic wounds. However, successful outcomes depend on appropriate patient selection and diligent monitoring. To establish stronger clinical guidelines, further large-scale, randomized controlled trials with extended follow-up are needed. Future research should also explore cost-effectiveness, patient-reported quality of life outcomes, and the integration of VAC therapy with adjunctive treatments such as antimicrobial dressings or regenerative biomaterials, thereby expanding its role in comprehensive diabetic wound management.

## CONTRIBUTION OF AUTHORS

**Research concept-** Sudarshan N, Narashimhaswamy P

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**Article editing-** Sudarshan N, Ravikiran KV

**Final approval-** Sudarshan N, Narashimhaswamy P

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