SSR Institute of International Journal of Life Sciences
ISSN (O): 2581-8740 | ISSN (P): 2581-8732
Anitha Rani *et al*., 2025
doi: 10.21276/SSR-IIJLS.2025.11.5.17

Original Article

open access

Effect of Vacuum-Assisted Dressings in Diabetic Wounds

Anitha Rani NA[1], Sathkar U Shetty[2]*, Lingaraju N[3]

[1]Assistant Professor, Department of Surgery, MIMS, Mandya, India
[2]Post Graduate, Department of Surgery, MIMS, Mandya, India
[3]Associate Professor, Department of Surgery, MIMS, Mandya, India

***Address for Correspondence:** Dr. Sathkar U Shetty, Post Graduate, Department of Surgery, MIMS, Mandya, India
E-mail: sathkarus@gmail.com

Received: 13 Apr 2025/ Revised: 23 Jun 2025/ Accepted: 22 Aug 2025

ABSTRACT

Background: Diabetic wounds represent a major clinical and public health challenge due to delayed healing, frequent infections, and the risk of amputation. Conventional dressings often fail to provide adequate results, leading to prolonged morbidity. Vacuum-assisted closure (VAC) therapy, a form of negative pressure wound therapy (NPWT), has been developed to accelerate wound healing by enhancing granulation, reducing edema, controlling infection, and preparing wounds for definitive closure.

Methods: An interventional study was conducted on 30 patients with diabetic ulcers admitted to our institution. All patients underwent VAC therapy using continuous negative pressure at –125 mmHg. Wound evaluation was performed using a standardized wound scoring system that assessed granulation tissue area, color, and consistency over 10 days. Baseline demographic, clinical, and microbiological profiles were also recorded.

Results: Of the 30 patients, 22 (73.3%) were male, with the majority belonging to the 41–50-year age group. Most ulcers were of traumatic origin (63.3%). Patients with controlled diabetes demonstrated better wound response compared to those with poor glycemic control. The most common organisms isolated were S. aureus, P. aeruginosa, and Proteus species. By day 10, more than 70% of cases achieved a wound score >5, indicating readiness for grafting. VAC therapy resulted in reduced exudate, faster granulation, and effective control of infection.

Conclusion: VAC therapy significantly improved wound healing outcomes in diabetic ulcers by accelerating granulation tissue formation, reducing bacterial burden, and preparing wounds for secondary closure. It appears to be a safe and effective alternative to conventional wound management.

Key-words: Diabetic wounds, Negative pressure wound therapy, VAC, Granulation, Healing

INTRODUCTION

Diabetes mellitus is a major global health problem, with foot complications being among the most disabling outcomes. Diabetic foot ulcers account for significant morbidity, prolonged hospitalization, and increased risk of lower limb amputation [1,2]. The impaired wound healing in these patients is attributed to peripheral neuropathy, poor vascular supply, recurrent infections, and altered immune responses [3]. These factors not only delay recovery but also increase the economic burden on patients and healthcare systems [4].

Conventional methods of wound care, such as saline or moist dressings, require frequent changes and often fail to achieve rapid granulation and closure [5]. In recent years, VAC therapy, also known as NPWT, has emerged as an effective alternative. The mechanism involves the application of controlled sub-atmospheric pressure, which reduces edema, enhances local perfusion, decreases bacterial colonization, and stimulates granulation tissue formation [6].

Clinical studies have shown that VAC therapy accelerates wound healing and reduces complications compared to traditional dressings [7]. A multicenter randomized controlled trial demonstrated complete ulcer closure in 43.2% of diabetic patients treated with VAC therapy

How to cite this article
Anitha-Rani NA, Shetty SU, Lingaraju N. Effect of Vacuum-Assisted Dressings in Diabetic Wounds. SSR Inst Int J Life Sci., 2025; 11(5): 8315-8319.

Access this article online
https://iijls.com/

doi: 10.21276/SSR-IIJLS.2025.11.5.17

within 112 days, compared to only 28.9% in the moist wound therapy group, along with fewer amputations [8]. The present study was undertaken to evaluate the effectiveness of VAC therapy in diabetic wounds with reference to wound granulation, healing response, and infection control.

MATERIALS AND METHODS

Study Design and Setting- This prospective interventional study was conducted in all surgical units of Mandya Institute of Medical Science, Mandya, from January 2024 to June 2025. It included inpatients presenting with diabetic wounds.

Sample Size and Selection Criteria- A total of 30 patients aged between 30–60 years, clinically diagnosed with diabetic ulcers, were enrolled during the study period. Patients were selected based on clinical examination using a structured proforma.

Inclusion Criteria- All patients with Type 2 Diabetes Mellitus (DM) presenting with ulcers in the age group between 30 and 60 years

Exclusion Criteria- Patients older than 60 years**,** immunocompromised or other associated arterial or venous disorders not related to diabetes mellitus.

Data Collection and Follow-up- Each patient underwent a detailed clinical examination, wound preparation involved removal of existing dressings, collection of wound swabs for culture, irrigation with normal saline, and surgical debridement. A sterile, open-cell foam dressing was placed into the wound cavity, sealed with an adhesive drape, and connected to a vacuum system applying continuous negative pressure (-50 to -125 mm Hg) for 3 days or as required. Patients received insulin therapy (Inj. H. Mixtard 30/70) based on daily random blood sugar levels. Wounds were evaluated on Days 3, 7, and 10 using a wound scoring system, assessing: Granulation tissue coverage (None=0 to Complete=4), Colour (Pale=0 to Bright Red=2), Consistency (Spongy=0, Solid=1).

Statistical Analysis- Data were analyzed using descriptive statistics. The granulation, colour, and consistency scores were recorded at each follow-up and compared using appropriate non-parametric tests (e.g., Kruskal-Wallis, Mann-Whitney) with significance set at p≤0.05.

Ethical Approval– The study received clearance from the Institutional Ethics Committee of MIMS, Mandya. Informed written consent was obtained from all participants before inclusion in the study.

RESULTS

Application of VAC therapy in a diabetic foot ulcer. The image shows the wound before therapy with unhealthy granulation and slough. After the VAC application, the foam dressing was sealed and connected to negative pressure (–125 mmHg). Progressive improvement was observed with a reduction in exudate and edema. By the end of the first week, granulation tissue covered nearly 60% of the wound bed, compared to <20% at baseline (Fig. 1).

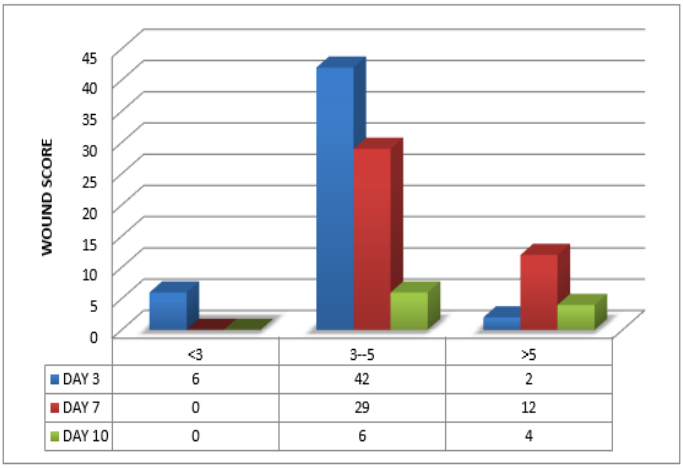

Fig. 1: Shows application of VAC therapy on a diabetic wound (before and during treatment)

Response of the wound following completion of VAC therapy. After three weeks of treatment, the ulcer size had reduced by more than 50%, with healthy red granulation tissue covering >80% of the wound surface. Signs of infection, such as purulent discharge and foul odor had resolved. The figure demonstrates the role of VAC therapy in accelerating wound contraction, promoting tissue regeneration, and preparing the ulcer for secondary closure or grafting (Fig. 2).

doi: 10.21276/SSR-IIJLS.2025.11.5.17

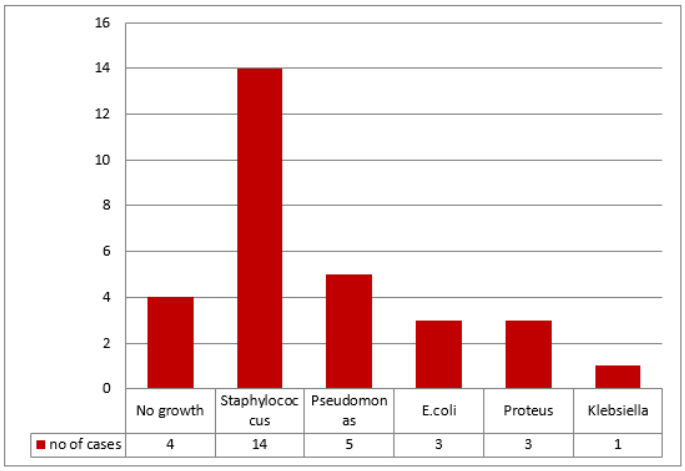

Fig. 2: Shows wound condition after VAC therapy, demonstrating granulation and healing

At presentation, the diabetic ulcer showed unhealthy slough, purulent discharge, foul odor, and surrounding edema. The wound bed had minimal granulation tissue (<20%) with a high risk of infection (Fig. 3).

Fig. 3: Diabetic wound before initiation of VAC therapy.

After one week of continuous VAC therapy at –125 mmHg, there was a marked reduction in exudate and edema. Fresh granulation tissue had developed, covering nearly 60% of the wound bed, with cleaner margins and decreased signs of infection (Fig. 4).

By the end of three weeks of VAC therapy, the ulcer size had reduced by more than 50%. Healthy red granulation tissue covered over four-fifths of the wound surface, infection had resolved, and the wound was adequately prepared for secondary closure or skin grafting (Fig. 5).

Fig. 4: Wound condition after one week of VAC therapy.

Fig. 5: Wound condition after three weeks of VAC therapy.

DISCUSSION

Delayed wound healing is a significant clinical challenge, particularly in patients with diabetes and associated comorbidities. These wounds often require repeated hospital visits and prolonged treatment. Conventional dressings may take several months for complete recovery, causing pain, psychological stress, and additional financial burden to the patient and family [9].

VAC therapy has been introduced as an alternative, making use of negative pressure to promote healing while reducing the frequency of painful dressing changes [10].

Although negative pressure wound therapy is considered expensive and not recommended as a first-line option in all cases, several authors have emphasized its value when used in selected patients and wounds at appropriate stages. It can modify the chronic wound environment and accelerate healing, though gaps remain between scientific evidence and widespread routine clinical practice [11].

Most published studies were small-scale, but several demonstrated better outcomes with VAC therapy than with conventional dressings. VAC-treated wounds showed faster granulation, reduced volume and depth, shorter treatment duration, and improved patient comfort. By reducing the frequency of dressings, VAC may also lower overall costs and improve patient satisfaction and quality of life [12,13].

In the present study, wound scoring was performed on parameters such as extent, color, and consistency of granulation tissue. Scores above five were considered suitable for skin grafting, and more than 70% of our cases achieved this level within one week of VAC therapy. This supports the role of VAC in preparing chronic wounds for definitive closure [14].

Optimal negative pressure for wound healing has been reported at approximately –125 mmHg [15]. Our findings confirm that VAC is generally well tolerated, with few contraindications, and improves graft uptake when used as a bolster over freshly grafted wounds. This makes it an increasingly important part of current wound care protocols [16].

Diabetes mellitus itself is a well-known factor for impaired healing. Experimental studies have demonstrated reduced leukocyte infiltration, lower levels of interleukin-6, and poor neovascularization in diabetic animals, resulting in delayed granulation tissue formation [17]. Clinical experience also confirms that advanced age, obesity, malnutrition, and vascular disease contribute to delayed healing and increased wound infection in diabetic patients [18].

In our series of 18 diabetic wounds managed by VAC therapy, early improvement was observed in 7 cases within the first three days. Some wounds, however, showed limited response, and two patients required amputation due to failure of both VAC and conventional therapy. Infection remained the major limiting factor, and in some cases, it worsened under closed VAC dressings. This indicates that wound debridement and infection control should precede VAC application for optimal benefit.

Technical difficulties, such as maintaining adequate negative pressure and ensuring contact between the foam and wound surface, were also encountered. These aspects, along with proper wound bed preparation, are crucial for success. Despite these challenges, VAC therapy remains a promising modality in the management of complex diabetic wounds, offering faster healing and improved outcomes compared to standard methods.

CONCLUSIONS

VAC therapy represents a relatively recent advancement in wound management and has altered the approach to treating complex wounds. Findings from our study, supported by previous research, indicate that VAC promotes faster healing with minimal complications, making it a valuable alternative to conventional methods. Although the technique is straightforward, proper training is essential for its safe and effective use. The cost of VAC therapy is influenced by factors such as hospital stay and the materials required. At present, there is a lack of large, high-quality randomized controlled trials evaluating its true efficacy and cost-effectiveness compared with standard dressings. Further studies with larger sample sizes are needed to establish its role across different wound types. Greater awareness and training will facilitate broader and more appropriate use of VAC in clinical practice.

CONTRIBUTION OF AUTHORS

Research concept– Anitha Rani N.A
Research design– Lingaraju N
Supervision– Lingaraju N
Materials– Anitha Rani N.A
Data collection– Sathkar U Shetty
Data analysis and interpretation– Anitha Rani N.A
Literature search– Anitha Rani N.A
Writing article– Sathkar U Shetty
Critical review– Lingaraju N
Article editing– Lingaraju N
Final approval– Anitha Rani N.A

doi: 10.21276/SSR-IIJLS.2025.11.5.17

REFERENCES

[1] Singh N, Armstrong DG, Lipsky BA. Preventing foot ulcers in patients with diabetes. JAMA, 2005; 293(2): 217-28.

[2] Boulton AJ, Vileikyte L, Ragnarson-Tennvall G, Apelqvist J. The global burden of diabetic foot disease. Lancet, 2005; 366(9498): 1719-24.

[3] Jeffcoate WJ, Harding KG. Diabetic foot ulcers. Lancet, 2003; 361(9368): 1545-51.

[4] Rice JB, Desai U, Cummings AK, Birnbaum HG, Skornicki M, Parsons NB. Burden of diabetic foot ulcers for Medicare and private insurers. Diabetes Care, 2014; 37(3): 651-58.

[5] Dumville JC, Deshpande S, O'Meara S, Speak K. Foam dressings for healing diabetic foot ulcers. Cochrane Database Syst Rev., 2013; 6: CD009111.

[6] Argenta LC, Morykwas MJ. Vacuum-assisted closure: a new method for wound control and treatment. Ann Plast Surg., 1997; 38(6): 563-76.

[7] Blume PA, Walters J, Payne W, Ayala J, Lantis J. Comparison of negative pressure wound therapy using vacuum-assisted closure with advanced moist wound therapy in the treatment of diabetic foot ulcers. Diabetes Care, 2008; 31(4): 631-36.

[8] Armstrong DG, Lavery LA, et al. Negative pressure wound therapy vs advanced moist wound therapy in the treatment of diabetic foot ulcers: a multicenter randomized controlled trial. Diabetes Care, 2005; 28(3): 551-56.

[9] Weed T, Ratliff C, Drake DB. Quantifying bacterial bioburden during negative pressure wound therapy. Ann Plast Surg., 2004; 52(3): 276-79.

[10] Ravari H, Modaghegh MH, Kazemzadeh GH, Johari HG, Vatanchi AM. Comparison of vacuum-assisted closure vs saline gauze dressing in the treatment of diabetic foot ulcers. J Cutan Aesthet Surg., 2013; 6(1): 17-20.

[11] Vuerstaek JD, Vainas T, Wuite J, Nelemans P, Neumann MH, et al. State-of-the-art treatment of chronic leg ulcers: a randomized controlled trial comparing vacuum-assisted closure with modern wound dressings. J Vasc Surg., 2006; 44(5): 1029-37. doi: 10.1016/j.jvs.2006.07.030.

[12] Clare MP, Fitzgibbons TC, McMullen ST, et al. Experience with the vacuum-assisted closure negative pressure technique in the treatment of non-healing diabetic and trauma wounds. Foot Ankle Int. 2002; 23(10): 896-901.

[13] Mouës CM, van den Bemd GJ, Meerding WJ, Hovius SE. An economic evaluation of the use of TNP on full-thickness wounds. J Wound Care, 2005; 14(5): 224-27.

[14] Apelqvist J, Armstrong DG, Lavery LA, Boulton AJ. Resource utilization and economic costs of care based on a randomized trial of vacuum-assisted closure therapy in the treatment of diabetic foot wounds. Am J Surg., 2008; 195(6): 782-88.

[15] Dowsett C, Newton H. Wound bed preparation: TIME in practice. Wounds UK, 2005; 1(3): 48-70. Available at: https://wounds-uk.com/journal-articles/wound-bed-preparation-time-in-practice-1/.

[16] Jeffcoate WJ, Harding KG. Wound healing and treatments for people with diabetic foot ulcers. Clin Evid., 2004; 12: 1754-65.

[17] Jude EB, Apelqvist J, Spraul M, Martini J. Prospective randomized controlled study of hydrosurgery debridement versus conventional surgical debridement in diabetic foot ulcers. Diabet Med., 2007; 24(3): 280-85.

[18] Steed DL, Attinger C, Colaizzi T, Crossland M, Franz M, Harkless L, et al. Guidelines for the treatment of diabetic ulcers. Wound Repair Regen., 2006; 14(6): 680-92.