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Case Report

Surgery Section

Negative Pressure Wound Therapy with Instillation and Dwell Time using Vacuum Assisted Closure Novel Foam Dressing as a Limb Salvaging Strategy in a Complex Diabetic Plantar Ulcer: A Case Report

BHAVYAL SINHA[1], R MANIMARAN[2], K KANCHANA BATRA[3]

ABSTRACT

Diabetic foot ulcers remain a major cause of morbidity and lower limb amputation worldwide, particularly in patients with neuropathy, ischaemia, and infection where conventional wound care often fails. Complex plantar ulcers are especially difficult to manage due to persistent pressure loading, deep tissue involvement, and biofilm formation, necessitating advanced wound management strategies. The present case is of a 70-year-old male with poorly controlled type 2 diabetes mellitus who presented with a chronic non healing infected plantar ulcer of six months duration following prior vascular intervention and partial toe amputation. Clinical evaluation revealed a large full-thickness ulcer with exposed musculature and significant slough without systemic sepsis. Following radical surgical debridement, Negative Pressure Wound Therapy with Instillation and Dwell time (NPWTi-d) using a novel foam dressing was initiated with normal saline instillation at -125 mmHg. Rapid wound improvement was observed, with significant reduction in slough after the first cycle, approximately 70% granulation tissue formation after the second cycle, and complete healthy wound bed preparation after the third cycle. Definitive split skin grafting was performed with complete graft uptake and successful limb salvage. This case highlights that early use of negative pressure wound therapy with instillation and dwell time after adequate debridement can accelerate wound bed preparation, reduce infection burden, and improve outcomes in complex diabetic plantar ulcers, supporting its role as an effective limb-salvaging modality in high-risk patients.

Keywords: Diabetic foot, Debridement, Skin transplantation, Wound healing

CASE REPORT

A 70-year-old male patient presented with foul-smelling discharge, progressive increase in ulcer size, and difficulty in weight-bearing, along with functional limitation in ambulation. The history of present illness revealed that the ulcer initially began as a small blister which gradually progressed despite local dressings. He had undergone right femoro-popliteal angioplasty six months prior for peripheral arterial disease and amputation of the fourth and fifth toes four months earlier due to gangrene. His past medical history was significant for poorly controlled type 2 diabetes mellitus of more than 15 years duration, with a recent glycated haemoglobin level of 9.2%, along with diabetic neuropathy. There was no significant family history of similar conditions, and no history of smoking or alcohol use.

On physical examination, the patient was afebrile with stable vital signs. Local examination of the right foot revealed a large full-thickness plantar ulcer measuring approximately 6×5 cm, with exposed intrinsic musculature, thick adherent slough, surrounding cellulitis, and foul odour. Peripheral pulses were palpable but reduced, and the ankle-brachial index was 0.8, suggestive of mild peripheral arterial disease. Sensory examination confirmed peripheral neuropathy. Systemic examination was otherwise unremarkable. Laboratory investigations revealed leucocytosis, elevated inflammatory markers, and poor glycaemic control, as summarised in [Table/Fig-1], while radiography of the foot did not reveal any underlying bony involvement. Wound culture demonstrated mixed bacterial growth. Based on clinical and laboratory findings, a diagnosis of infected diabetic plantar ulcer without radiological evidence of osteomyelitis was made, with differentials including deep soft-tissue infection and early osteomyelitis.

Parameter	Value	Reference range	Interpretation
Haemoglobin (g/dL)	11.2	13-17	Mild anaemia
Total leucocyte count (/mm^3)	14,800	4,000-11,000	Leucocytosis (infection)
Neutrophils (%)	82	40-75	Neutrophilia
C-reactive protein (mg/L)	48	<10	Elevated (inflammation)
Erythrocyte sedimentation rate (ESR) (mm/hr)	62	<20	Elevated
HbA1c (%)	9.2	<7	Poor glycaemic control
Random blood glucose (mg/dL)	248	<140	Hyperglycaemia
Serum creatinine (mg/dL)	1.1	0.6-1.2	Normal
Wound culture	Mixed bacterial growth	-	Polymicrobial infection

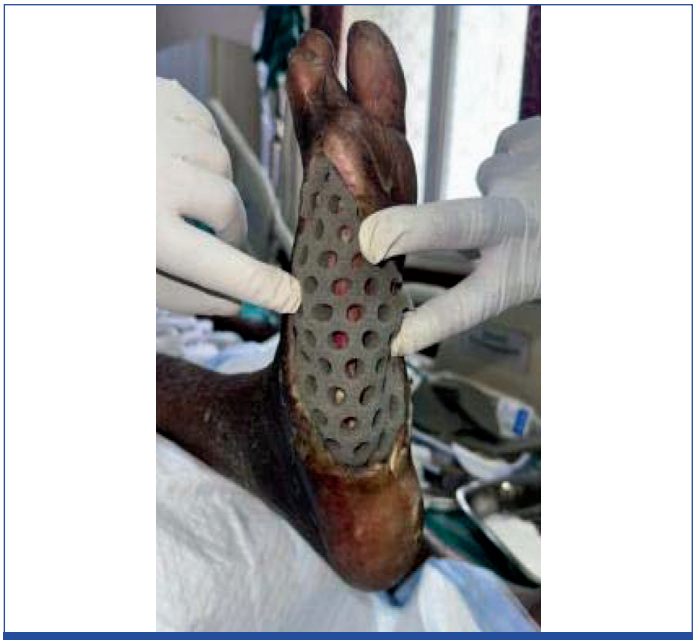
[Table/Fig-1]: Baseline laboratory parameters.

The patient underwent extensive surgical debridement with removal of necrotic fascia, non viable muscle, and devitalised tissue while preserving viable structures [Table/Fig-2]. Following adequate wound bed preparation, NPWTi-d using a novel foam dressing was initiated [Table/Fig-3,4]. Normal saline was used as the instillation solution with a dwell time of 10 minutes, continuous negative pressure of -125 mmHg, and cycles every 2-3 hours. Dressings were changed every 48-72 hours. The patient was managed with broad-spectrum intravenous antibiotics, later tailored according to culture sensitivity, along with optimisation of glycaemic control using insulin therapy

and standard supportive measures including wound care and strict off-loading. The wound showed marked clinical improvement, with significant reduction in slough and odour after the first cycle, approximately 70% healthy granulation tissue formation after the second cycle, and a uniform well-granulated wound bed after the third cycle [Table/Fig-5,6].

[Table/Fig-2]: Predebridement clinical presentation.

[Table/Fig-3]: Postradical debridement wound bed.



[Table/Fig-4]: NPWTi-d novel foam dressing and dual irrigation system application.

[Table/Fig-5]: Post 3 cycles of NPWTi-d novel foam dressing wound bed.

[Table/Fig-6]: Well-granulated wound bed prior to definitive closure.

Once optimal wound bed preparation was achieved, definitive split skin grafting was performed resulting in complete graft uptake without any evidence of graft loss or infection [Table/Fig-7]. The treatment response was favourable, with rapid reduction in slough, progressive granulation tissue formation, and complete conversion to a healthy wound bed within three cycles of therapy. The patient was advised strict off-loading, glycaemic control, and regular wound care. On follow-up at two weeks, the graft was well-adhered with no signs of infection or necrosis, and by six weeks, complete wound healing was observed with satisfactory functional outcome. There was no recurrence of ulceration, and the patient regained the ability to ambulate with support, confirming successful limb salvage.

[Table/Fig-7]: Post-Split Skin Grafting (SSG) outcome.

DISCUSSION

Diabetic foot ulcers are complex chronic wounds arising from the interplay of neuropathy, ischaemia, and infection, and remain a major cause of morbidity and lower limb amputation. Effective management requires rapid wound bed preparation, infection control, and restoration of tissue viability. Negative pressure wound therapy has been shown to significantly enhance wound healing by promoting angiogenesis, reducing oedema, and accelerating granulation tissue formation, with meta-analyses demonstrating improved healing rates and reduced amputation risk compared to conventional dressings [1,2].

NPWTi-d represents an advancement over standard Negative Pressure Wound Therapy (NPWT) by incorporating periodic irrigation of the wound bed. This approach facilitates removal of exudate, debris, and microbial burden, particularly in complex infected wounds. A systematic review of randomised controlled trials by Kanapathy M et al., demonstrated that NPWT with instillation significantly reduced the number of surgical procedures and dressing changes and resulted in a greater reduction in wound area compared to standard NPWT, although no significant difference was observed in overall healing rates or time to healing [3]. Similarly, Kim PJ et al., reported no statistically significant differences in healing outcomes between NPWT and NPWT with instillation, highlighting that the benefit of instillation may be context-dependent [4].

The mechanism underlying the effectiveness of NPWTi-d is attributed to both mechanical and biological effects. Negative pressure induces microdeformation, enhances perfusion, and removes interstitial fluid, while instillation disrupts biofilm and reduces bacterial load, which are critical barriers to healing in chronic wounds [3,5]. Studies evaluating wound bioburden have demonstrated that instillation therapy can improve wound cleansing and reduce bacterial colonisation compared to standard therapy, particularly in contaminated wounds [6-9]. These findings support the observed rapid wound bed preparation and granulation tissue formation in the present case.

However, current evidence suggests that the superiority of NPWTi-d over conventional NPWT is not uniform across all patient populations. Meta-analyses and pooled studies indicate no significant differences in wound closure rates, hospital stay, or adverse events between the two modalities, emphasising that the effectiveness of NPWTi-d may depend on factors such as adequacy of initial debridement, wound severity, and presence of infection [3,7]. In cases with extensive slough or heavy contamination, as seen in the present patient, the additional benefit of instillation may be more pronounced.

Despite its clinical advantages, NPWTi-d has several limitations. The requirement for specialised equipment and trained personnel, along with increased cost, may limit its use in resource-constrained settings. Furthermore, its effectiveness is reduced in ischaemic wounds unless adequate revascularisation is achieved [8]. Potential complications include bleeding, maceration, and technical issues related to improper sealing or device handling [5]. Therefore, careful patient selection and strict adherence to protocol are essential for optimal outcomes [9,10].

This case demonstrates that early application of NPWTi-d following adequate surgical debridement can significantly accelerate wound bed preparation and facilitate successful limb salvage. The rapid progression from infected ulcer to a graft-ready wound within a short duration aligns with current evidence supporting its role in complex diabetic wounds. However, given the heterogeneity of existing studies, further large-scale randomised trials are required to establish standardised treatment protocols and define precise indications for NPWTi-d in diabetic foot management.

CONCLUSION(S)

The NPWTi-d Therapy with novel foam dressing is an effective adjunct in managing complex infected diabetic plantar ulcers. Early initiation after adequate debridement accelerates wound bed preparation, reduces microbial burden, and facilitates timely closure. This case supports NPWTi-d as a valuable limb-salvaging modality in advanced diabetic foot infections.

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PARTICULARS OF CONTRIBUTORS:
1. Postgraduate Student, Department of General Surgery, Sree Balaji Medical College and Hospital, Chennai, Tamil Nadu, India.
2. Associate Professor, Department of General Surgery, Sree Balaji Medical College and Hospital, Chennai, Tamil Nadu, India.
3. Assistant Professor, Department of Plastic Surgery, Sree Balaji Medical College and Hospital, Chennai, Tamil Nadu, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. R Manimaran,
Associate Professor, Department of General Surgery, Sree Balaji Medical College and Hospital, New CLC Road, Chromepet, Chennai-600044, Tamil Nadu, India.
E-mail: manigex@gmail.com

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