CASE STUDY

Preventable pitfalls in negative pressure wound therapy: clinical lessons from four cases

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Abstract

Background Negative pressure wound therapy is widely used in the management of complex acute and chronic wounds. Although its benefits are well established, technical deviations in routine practice may compromise effectiveness and lead to preventable complications.

Cases Four cases encountered in routine clinical care are presented to illustrate common and avoidable technical errors during negative pressure wound therapy application.

Findings Identified errors included inadequate wound bed preparation, omission of a wound contact layer, inappropriate interface material placement and delayed management of dressing leakage. These deviations were associated with tissue trauma, periwound maceration, delayed granulation and impaired negative pressure transmission. Recognition of these issues and timely corrective interventions allowed safe continuation of therapy and improved wound progression.

Clinical implications These cases highlight that successful negative pressure wound therapy depends not only on appropriate indication but also on meticulous application and consistent monitoring. Structured clinical oversight and adherence to standardised principles may reduce avoidable complications and improve patient safety.

Keywords negative pressure wound therapy, patient safety, technical errors, wound care, wound management.

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Key points

- Technical errors in negative pressure wound therapy may compromise healing outcomes.
- Inadequate debridement and omission of a wound contact layer increase complication risk.
- Persistent leakage requires early reassessment to prevent periwound damage.
- Corrective intervention enables safe continuation of therapy.
- Consistent clinical monitoring is essential for optimal treatment delivery.

Introduction

Negative pressure wound therapy (NPWT) is a widely used, evidence-based modality for the management of acute and chronic wounds, including pressure injuries, diabetic foot ulcers, postoperative wounds, burns and trauma-related defects.[1-3] By applying controlled negative pressure through a sealed dressing system, NPWT promotes wound healing by enhancing tissue perfusion, stimulating granulation tissue formation, and effectively managing wound exudate.[4,5] Multiple commercially available NPWT systems are currently available; however, despite differences in device design, the fundamental therapeutic principles remain consistent across systems. These include appropriate wound bed preparation, correct interface selection, and reliable dressing sealing to ensure effective negative pressure delivery and optimal wound healing conditions.[6]

Clinical studies have shown that NPWT can accelerate wound closure, reduce surgical site infections, and decrease

the frequency of dressing changes, thereby improving patient comfort and optimising healthcare resources.[7-9] Although NPWT systems may initially appear costly, several economic analyses have demonstrated that they can be cost-effective in patients with complex wounds by reducing healing time, hospital stay, and overall treatment costs.[10] Driver et al[10] reported that NPWT may provide economic advantages particularly in patients with multiple comorbidities and severe wounds by decreasing complication rates and the need for repeated interventions. However, these benefits depend not only on appropriate indication but also on correct application and ongoing clinical oversight. Technical deviations, such as inadequate wound bed preparation, inappropriate material selection, omission of a wound contact layer, or delayed management of dressing-related complications, may compromise treatment effectiveness and lead to preventable adverse outcomes, including bleeding, periwound maceration, pain and infection.[11-13]

Application-related errors are often associated with inconsistent adherence to established principles, variability in practitioner experience, or gaps in communication within the care team. In addition to clinical experience, several international guidelines emphasise the importance of standardised preparation and application of NPWT systems. The European Wound Management Association (EWMA) highlights that effective NPWT requires careful wound assessment, adequate debridement, correct interface selection and secure dressing application to ensure safe pressure transmission and patient safety. Failure to follow these principles may increase the risk of complications and compromise treatment outcomes.[6] The involvement of trained wound care professionals and effective multidisciplinary collaboration are, therefore, essential to ensure safe, consistent and evidence-based NPWT practice.[14]

While NPWT efficacy has been extensively studied, fewer reports focus on preventable application-related deviations encountered in routine clinical settings. Given the potential risks associated with improper NPWT use, this report presents four clinical cases encountered in routine practice that illustrate preventable technical pitfalls and their clinical consequences. The objective is to provide practical insights that may support safer application and improve clinical decision-making in complex wound management.

Case presentations

Following approval from the institutional ethics committee, this case-based report includes four patients treated with NPWT in a tertiary care setting between 2023 and 2024. Wound photographs were obtained as part of routine clinical documentation, and written informed consent was secured for the use of anonymised clinical information and images.

Although the patients had different underlying diagnoses, similar application-related issues were identified. Observed errors included failure to perform adequate debridement prior to NPWT initiation, omission of a wound contact layer, inappropriate placement of interface materials between the wound and foam dressing, and delayed response to persistent dressing leakage.

These deviations resulted in clinically relevant complications, such as delayed granulation tissue formation, adherence of the foam dressing to fragile wound surfaces, periwound maceration with secondary dermatitis and ineffective negative pressure transmission. In each case, recognition of the technical issue led to corrective interventions, including appropriate debridement, correct interface selection, improved sealing techniques and multidisciplinary reassessment. Following these measures, wound progression improved and NPWT was safely continued or transitioned according to clinical needs.

In all cases, NPWT was delivered at a continuous setting of –125mmHg. Dressing changes were performed at 48–72hour intervals based on clinical assessment, and the overall duration of therapy varied according to wound progression. A summary of the cases, identified technical errors and clinical outcomes is presented in Table 1.

Case 1. Application of NPWT without debridement

A 62-year-old immobile woman was hospitalised with a

Table 1. Summary of cases, application errors and clinical outcomes

Case	Age in yrs/sex	Diagnosis	Application error	Complication	Outcome
1	62/F	Pressure ulcer (sacral region)	NPWT initiated without prior debridement	Delayed granulation and prolonged healing	Healed after corrective debridement and continued NPWT
2	5/M	Flame burn (scalp)	Omission of wound contact layer	Sponge adherence and graft delay	Recovered after debridement and correct NPWT reapplication
3	46/M	Fournier's gangrene	Leakage with delayed dressing change	Periwound maceration, dermatitis, fungal infection	Resolved after temporary discontinuation and resumed NPWT
4	62/F	Chronic post-arthroplasty wound (knee)	NPWT applied over inappropriate interface material	Ineffective vacuum transmission and delayed granulation	Prepared for final orthopedic closure

sacral pressure injury characterised by full-thickness skin and tissue loss with necrotic material present in the wound bed, indicating inadequate wound bed preparation prior to therapy. NPWT was initiated without prior debridement. During follow-up assessment, inadequate granulation tissue formation was observed and necrotic material was noted adherent to the foam dressing (Figure 1), indicating insufficient wound bed preparation.

Figure 1. NPWT initiated without prior debridement

Sharp debridement was subsequently performed, and NPWT was continued for three additional dressing change cycles performed at 48–72-hour intervals. After development of a healthy granulation bed, the patient was transitioned to conventional dressings and complete wound closure was achieved.

Clinical Insight: Initiating NPWT without adequate debridement may delay healing. Ensuring a clean, viable wound bed prior to therapy is essential for optimal treatment response.

Case 2. Application of NPWT without a wound contact layer

A 5-year-old boy sustained flame burns to his scalp involving approximately 30% total body surface area. After surgical stabilisation and debridement, NPWT was applied without a wound contact layer. A wound contact layer is a protective interface dressing placed between the wound bed and the foam dressing to prevent direct adhesion of the foam to the wound surface while allowing wound exudate to pass into the NPWT system. According to EWMA guidance, the use of appropriate interface materials is particularly important in wounds with fragile tissue or newly forming granulation tissue in order to reduce tissue trauma and pain during dressing removal while maintaining effective negative pressure transmission.[6] At the time of dressing removal, the foam dressing was found to be adhered to the wound surface, causing pain and partial disruption of newly formed granulation tissue (Figure 2). Repeat debridement was required.

NPWT was reapplied using an appropriate wound contact layer, resulting in improved wound progression and reduced discomfort.

Clinical Insight: Omission of a wound contact layer increases the risk of tissue adherence and trauma, particularly in fragile or pediatric wounds. Protective interface materials should be used when indicated.

Case 3. Leakage and dressing management errors in NPWT

A 46-year-old man with Fournier's gangrene underwent surgical debridement followed by NPWT. Fournier's gangrene is a rapidly progressive form of necrotising fasciitis affecting the perineal and genital regions and represents a surgical emergency requiring prompt surgical debridement and aggressive wound management.[15] Persistent leakage around the dressing was noted but not addressed for more than 48 hours. This delay led to excessive exudate accumulation, periwound maceration, dermatitis and secondary fungal infection (Figure 3).

NPWT was temporarily discontinued for five days. Local wound care, including surfactant-based irrigation and topical antifungal-zinc preparations, was initiated. After improvement of the periwound condition, NPWT was restarted for three additional sessions, followed by definitive surgical closure.

Clinical Insight: Unresolved leakage can rapidly lead to periwound skin damage. Prompt reassessment and timely

Figure 2. NPWT applied without the use of a wound contact layer

Figure 3. NPWT with leakage and periwound skin damage due to delayed dressing changes

dressing replacement are critical to prevent secondary complications.

Case 4. Incorrect use of NPWT over foreign material

A 62-year-old woman with a chronic postoperative knee wound following total arthroplasty (total knee replacement) underwent debridement and placement of an antibiotic spacer. NPWT was initiated; however, sterile gauze had been placed between the wound surface and foam dressing, compromising effective negative pressure transmission (Figure 4). A wound contact layer was also absent.

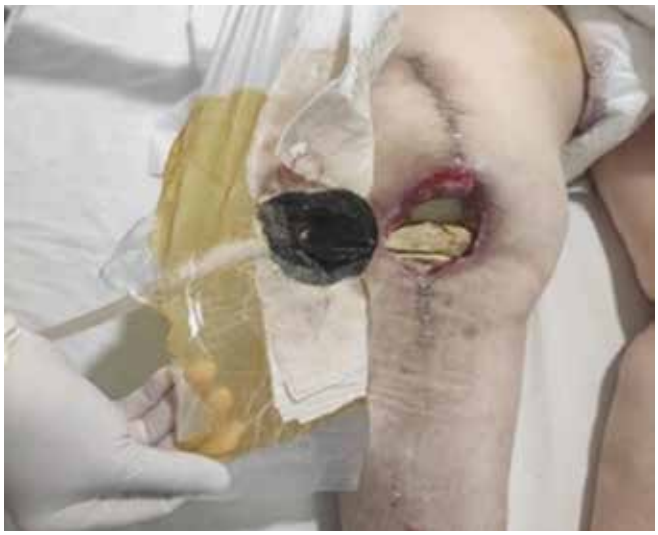

Figure 4. NPWT with impaired negative pressure transmission due to the use of inappropriate interface materials

After multidisciplinary review, NPWT was reapplied using appropriate materials and correct interface technique. Four additional NPWT dressing change sessions resulted in improved granulation tissue formation and preparation for definitive surgical closure.

Clinical Insight: Placement of non-indicated materials between the wound and foam dressing may impair pressure transmission and delay healing. Proper interface selection is essential for effective NPWT delivery.

Discussion

Although NPWT is well established in acute and chronic wound management, its effectiveness depends on careful technical execution and ongoing monitoring.[1–3,12,16] As demonstrated in the present cases, seemingly minor deviations from recommended practice may compromise therapeutic outcomes and lead to preventable complications in routine clinical settings. These observations are consistent with recommendations outlined in international NPWT guidance. The EWMA document emphasises that successful NPWT therapy depends not only on selecting an appropriate device but also on meticulous wound bed preparation, correct interface material selection, and continuous monitoring of dressing integrity and exudate management. Inadequate adherence to these principles may compromise negative pressure transmission and contribute to avoidable complications similar to those described in the present cases.[6]

In Case 1, inadequate wound bed preparation resulted in delayed granulation and prolonged healing. NPWT is most effective when applied to viable, well-vascularised tissue; the presence of necrotic material may impair exudate management and reduce treatment efficacy.[1,2] Applying NPWT over non-viable tissue is, therefore, contraindicated and should be avoided.[5,7,17] These findings reinforce the fundamental principle that proper debridement remains a prerequisite for successful NPWT.

Cases 2 and 4 underscore the importance of appropriate interface selection. Omission of a wound contact layer allowed direct contact between the foam and fragile tissue, resulting in adherence and tissue trauma. Similarly, placement of non-indicated materials between the wound and foam impaired negative pressure transmission and disrupted system integrity. Appropriate wound contact layer use particularly in wounds with exposed bone or foreign material helps preserve tissue integrity, reduce pain, and maintain an optimal healing environment.[18] These cases highlight that correct interface technique is not optional but central to effective NPWT delivery.

Case 3 illustrates the consequences of delayed management of persistent leakage. Technical malfunctions, such as seal failure may interrupt therapy and increase the risk of maceration and secondary skin damage.[7] Early detection and timely intervention are therefore essential. NPWT should be viewed as a dynamic therapy requiring ongoing reassessment rather than a single procedural event.

The literature emphasises the importance of structured training, standardised protocols and risk-awareness strategies to enhance NPWT safety.[13] Consistent with these recommendations, the cases presented here suggest that clear role definition, competency-based training and effective nurse–physician communication may reduce avoidable complications.[16]

Clinical practice recommendations

- Ensure complete debridement prior to NPWT initiation, as necrotic or non-viable tissue may impair negative pressure transmission and delay granulation tissue formation.
- Use a wound contact layer when fragile tissue, exposed bone or foreign material is present, as this protective interface helps prevent foam adherence, reduces pain during dressing removal, and preserves newly formed granulation tissue.
- Reassess and address persistent leakage within 24 hours, since prolonged seal failure may interrupt therapy and lead to periwound maceration or secondary skin complications.
- Avoid placing non-indicated materials between the wound and foam, as inappropriate interface materials may disrupt pressure transmission and reduce treatment effectiveness.

- Establish clear interprofessional communication pathways for NPWT monitoring, ensuring early identification of complications and timely adjustment of treatment strategies.
- Follow manufacturer instructions for NPWT device preparation, dressing application and pressure settings, as adherence to device-specific guidance is essential for safe operation and optimal therapy delivery.

Conclusion

These cases demonstrate that preventable technical deviations can significantly affect NPWT outcomes. Ensuring adequate debridement, appropriate interface selection and prompt management of device-related issues are essential components of safe and effective therapy. Increased clinical awareness, structured monitoring and adherence to established NPWT principles may help minimise avoidable complications and improve patient safety in routine wound care settings. Adherence to established clinical guidance, including the recommendations published by the European Wound Management Association, may help standardise NPWT practice and reduce preventable complications in routine wound care settings.

Limitations

This report has several limitations. The small number of cases and single-center setting limit generalisability. As an observational case-based report, causal relationships cannot be established. Nevertheless, the cases provide practical clinical insights into preventable NPWT application errors encountered in routine practice.

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Conflict of interest

The authors declare that there are no conflicts of interest related to this study.

Ethics statement

Ethical approval was obtained from the relevant institutional ethics committee. Written informed consent was obtained from all patients for the use of their clinical data and images. All procedures were conducted in accordance with the principles of the Declaration of Helsinki.

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Author contributions

All authors contributed to the conception and design of the study. Data collection and clinical follow-up were performed by the authors. All authors contributed to drafting and critically revising the manuscript and approved the final version.

Artificial intelligence statement

Generative AI tools were used solely for language editing purposes. No AI tools were used in data generation, analysis or interpretation. The authors take full responsibility for the content of this manuscript.

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