

Negative Pressure Wound Therapy with Instillation for the Enhancement of Surgical Wound Management

DOROTHY MICHAELS, NP¹; ASHA GALLAGHER, DPT²; ERNEST FABROS, DPT²; LUZ MARINA PEÑA, DPT²; AMIT RAO, MD³; AND ALISHA OROPALLO, MD^{3,4}
¹Northwell Health Plainview/Syosset Hospital, Plainview, NY; ²Northwell Health LIJ Valley Stream Hospital, Valley Stream, NY; ³Northwell Health System, Department of Surgery, Comprehensive Wound Care Healing and Hyperbarics, Lake Success, NY 11042; ⁴Donald & Barbara Zucker School of Medicine at Hofstra/Northwell, Hempstead, NY

Introduction

Complex wounds do not follow the normal healing process. A wound is considered complex when one or more of the following criteria are met: there is extensive loss of the integument, presence of infection, compromised viability of tissue and supporting structures, and/or there is an association with systemic pathologies that impair normal healing (Raepsaet et al. 2022).

A retrospective chart review was performed at regional hospitals within the Northwell Health system. Two cases were identified as complex wounds and considered candidates for use of negative pressure wound therapy with instillation (NPWTi-d). Subjects were consulted by an interdisciplinary team.

NPWT with Instillation and Dwell Time (NPWTi-d) is the addition of instillation of a chosen solution to the wound base for preset 'dwell' time to standard VAC. NPWTi-d uses a more hydrophilic polyurethane foam, Reticulated Open Cell Foam-Cleanse Choice by KCI/3M (ROCF-CC), which allows mechanical solubilization of exudate-particulate through holes.

Standard NPWT vs NPWTi-d^[10] - NPWTi-d is better in reducing mean colony forming units per gram (CFU/g) for infected wounds in seven days of application.

Conventional dressing vs NPWTi-d^[10] - decreases in mean treatment days, time to wound closure, length of hospital stay, rate of recurrence of osteomyelitis, number of dressing changes and surgical debridement for NPWTi-d cases.



Clinical Cases

Fournier's gangrene (FG), a form of necrotizing fasciitis, is a rapidly progressive polymicrobial infection of the deep and superficial planes of the perineal and/or genital regions, sometimes through to the abdominal wall, that may quickly progress into a gangrenous process.

Case 1: 46-year-old man presented with complaints of pain in the groin and buttocks. Diagnosis of FG was made followed by incision and drainage (I&D) in the perineal area. This was an emergent procedure.

Hidradenitis suppurativa (HS) is a skin condition that causes painful lumps deep in your skin. These lumps usually develop on parts of the body where skin touches skin like the armpits, inner thighs, and groin area.

Case 2: 42-year-old man with a history of HS presented with infection of perineal region and I&D was performed. NPWT with instillation was started. This was an elective procedure.

Methods

- Wound Bed Preparation:
- Wound cleansed with normal saline
- No Sting Barrier Film Dressing (Cavilon, 3M) to periwound to protect intact or damaged skin.
- Non-adherent silicone dressing (Adaptic Touch, Acelity/Systgenix) was used as contact layer to protect exposed organs^[13].
- ROCF-CC wound contact layer with 1.0 cm diameter through holes was cut to size and placed in wound bed followed by either the 8mm or 16mm thicker contact layer to fill explored tunnels and wound depth.
- Foam dressings were secured with use of drape and hydrocolloid sheets to assist with achieving a collapsed seal.
- 1000 ml Sodium Chloride 0.9% IV injection bag (saline bag) was used as instillation solution, per recommendations^[13].
- Dressing changes took place every 2 to 3 days

	NPWT with Instillation Parameters per guidelines ^[13]	Chosen Parameters For Cases 1 and 2
NPWT i-d System		V.A.C. VeraFlo
Dwell time	1 to 20 minutes	5 minutes, 10 minutes
NPWT cycle duration	30 minutes to 3.5 hours	30 minutes, 2 hours
NPWT Settings	25 mmHg to 200 mmHg in increments of 25 mmHg, continuous negative pressure or dynamic pressure control	125 mmHg, low, continuous
Instillation Solution	Normal saline, hypochlorous acid solution, sodium hypochlorite solution	Normal saline
Initial Instillation Volume (Fill Assist Calculation)	Length X Width x 0.20	Case 1: 42 ml Case 2: 55 ml
Materials	ROCF-CC, Reticulated Open Cell (Veraflo) ROCF-V, Reticulated Open Cell Foam Dressing (Granufoam)	Reticulated Open Cell Foam Dressing (Cleanse Choice) ROCF-CC

Results

Case 1	4/4/2022	6/1/2022
Length	43 cm	8 cm
Width	17 cm	3 cm
Depth	8 cm	0.1 cm
Surface Area	731 cm	24 cm



Case 2	12/16/2022	1/20/2023
Length	57 cm	49 cm
Width	20 cm	18 cm
Depth	7 cm	1.8 cm
Surface Area	1140 cm	882 cm



Conclusion

Following debridement for these patients, non-viable tissue was still present in the wounds. The surgical team consulted PT wound care specialists to assess for NPWT candidacy. By using advanced wound care dressings, the need to return to the operating room (OR) for further debridement was eliminated.

NPWTi-d presents an adjunctive approach that lowers wound fluid viscosity, which in turn facilitates regular wound bed cleansing and infectious material removal and could be used in the management of complex and/or contaminated wounds (Zhang et al. 2021). Using these viscoelastic properties of the skin allows an extensive stretch of the skin in a shorter time frame, along with removing edema, stimulating angiogenesis, and granulation tissue that can bring the margins closer in less time (Gupta et al. 2022).

This form of therapy is indicated where there is greater than 50% of the wound bed with non-viable tissue. Adjustments were made to soak volumes and dwell times throughout the course of the therapies. The reduction in both soak and VAC times was reduced to maximize potential granulation formation and facilitate removal of the necrotic tissue, while allowing both patients to remain as mobile as possible during this time.

Case 1: By June 1, 2022, the wound had seen a 97% reduction in surface area. There was 100% granulation tissue formation and the wound edges were able to approximate. The patient returned to the OR for partial closure.

Case 2: By January 20, 2023, the wound had seen a 23% improvement. There wound was 100% granular and ready for graft placement.

Improving healing and closure rates for wounds is the goal for all advancements in wound care. This physiological micro and macroscopic benefits via negative pressure enabled the wounds to heal faster. The efficacy demonstrated by NPWTi-d to cleanse complex wounds and encourage the formation of granulation tissue can improve wound healing in complex cases such as those with FG and HS.

References

- Raepsaet, C., Alves, P., Cullen, B., Gefen, A., Lázaro-Martínez, J. L., Lev-Tov, H., Najafi, B., Santamaria, N., Sharpe, A., Swanson, T., Woo, K., & Beekman, D. (2022). Clinical research on the use of bordered foam dressings in the treatment of complex wounds: A systematic review of reported outcomes and applied measurement instruments. *Journal of tissue viability*, 31(3), 514–522. <https://doi.org/10.1016/j.jtv.2022.05.005>
- Gupta, A., Kundal, A., Mani, R., Gajula, B., Sindhuri, G., Chennat, J., Kumar, U., & Rajput, D. (2022). Negative pressure wound therapy in surgical practice: an institutional experience from a tertiary center of North India. *Polski przegląd chirurgiczny*, 95(1), 1–5. <https://doi.org/10.5604/01.3001.0015.8170>
- Zhang, B., Fan, X., Zhao, J., Shi, K., & Yu, J. (2021). Negative pressure wound therapy with instillation and dwell time in the wound management of necrotizing fasciitis. *Journal of Tissue Viability*, 30(2), 262–266. <https://doi.org/10.1016/j.jtv.2021.02.012>