Vacuum-Assisted Closure Therapy for a Complicated, Open, Above-the-Knee Amputation Wound

Kenneth Richter, DO
Brent Knudson, DO

From McClaren Oakland Hospital in Pontiac, Michigan.

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Address correspondence to Kenneth Richter, DO, 50 N Perry St, Pontiac, MI 48342-2217.

E-mail: richter143@gmail.com

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Negative-pressure wound therapy (NPWT) with a vacuum-assisted closure system has been successfully used in the management of various wounds on the trunk and distal extremities, including diabetic foot ulcers. However, reported successful NPWT cases have involved distal wounds that were below the knee. The authors report a case of an elderly diabetic patient with recalcitrant wounds in his left lower extremity from an above-the-knee amputation. The patient had undergone 27 surgical débridement or revision procedures over the course of 3 months. On entering rehabilitation, the patient had a full-thickness wound in his residual limb that measured 9 × 8 cm. The patient received NPWT with a vacuum-assisted closure system, which resulted in a fully healed residual limb. After 120 days, the patient was ready to begin prosthetic restoration.

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Proximal extremity wounds in diabetic patients are often difficult to heal. Negative-pressure wound therapy (NPWT) with a vacuum-assisted closure (VAC) system has been successfully used in the management of various wounds on the trunk and distal extremities, including diabetic foot ulcers.[1] One study[1] found that up to 25% of patients who underwent NPWT were less likely to undergo revision of their amputation than those who received conventional wound care. Although NPWT has been successful in the healing of extremity wounds, such as those caused by trauma or vascular events, to our knowledge all reported cases have involved distal wounds that occur below the knee. We report the case of an elderly diabetic patient who underwent NPWT with a VAC system for a full-thickness wound that measured 9 × 8 cm in an above-the-knee residual limb.

Report of Case

An elderly diabetic man with peripheral vascular disease, vasculitis, and pyoderma gangrenosa of his left lower extremity presented to the surgeon with nonhealing wounds. He subsequently underwent a below-the-knee amputation with a modified Ertl-type tibia-fibula fusion.[2] Several days after the procedure, however, he had subsequent incisional breakdown. Over the course of 75 days of hospitalization, he underwent 23 débridement or revision procedures as the infection progressed from skin to subcutaneous tissue, muscle, and bone. His wound failed to close after multiple attempts and was eventually left open to facilitate drainage. The patient underwent an above-the-knee amputation several months after the initial amputation as efforts to save the knee failed; however, he once again developed an infection at the surgical site and underwent 4 more débridement procedures. In addition, the patient had severe residual limb pain and developed encephalopathy related to his multiple surgical procedures and anesthesia.[3,4]

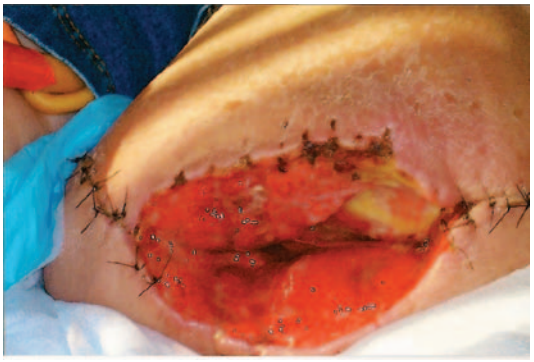

Figure 1.
An above-the-knee amputation wound in an elderly diabetic man at time of admission. The approximate size of the wound was 9 × 8 × 4 cm.

Figure 2.
A healed above-the-knee amputation wound in an elderly diabetic man after 3 months of vacuum-assisted closure therapy.

Rehabilitation staff were consulted, and it was decided to transfer the patient to an inpatient rehabilitation facility. At his presentation to the rehabilitation facility, the patient had a wound that was 9 × 8 cm in dimension and 4 cm deep (*Figure 1*). The most recent cultures prior to admission were positive for *Escherichia coli*. Although staff from the surgical and infectious disease departments thought another revision procedure was required, the rehabilitation staff were confident that viable bone stock remained. Treatment was consequently changed to an aggressive nonoperative course. The family was agreeable with the new treatment plan. The patient continued to have encephalopathy, along with substantial residual limb pain, which was rated as 10 out of 10, with 10 indicating severe pain.

The patient subsequently underwent wound VAC therapy at 125 mm Hg with continuous pressure. Antibiotics were continued and the patient was treated with broad spectrum antibiotics for 2 months. He was started on a full rehabilitation program, including a minimum of 3 hours of physical, occupational, and speech therapy. The wound VAC dressing was changed every 2 days. Thirty-two days later, the patient had improved from needing dependent assistance to needing stand-by assistance with a wheelchair. The patient's encephalopathy resolved, and his wound also showed marked improvement, decreasing to 4 × 4 cm in dimension with a depth of 1 cm. He was discharged to home with a pain score of 2 out of 10, home health care, and continuation of his wound VAC therapy. At home, wound VAC dressing changes were continued every 2 days. Granulation tissue continued to improve. After a total of 3 months of wound VAC therapy, the residual limb improved to a prosthetic-ready state (*Figure 2*). The patient developed renal failure from what appeared to be an autoimmune neutrophilic vasculitis, however, and he died before he received his prosthesis.

Comment

Wound healing in the presence of vasculopathies, such as diabetic, peripheral vascular, and peripheral arterial diseases, has been a daunting problem. As our patient demonstrated, even surgical treatment does not guarantee success. Although below-the-knee amputations with gaping wounds have been shown to heal with rigid, removable dressing,[5] above-the-knee amputations offer no place to anchor such a dressing. Since being introduced to the United States in 1995, NPWT has shown promising

success in chronic leg ulcers, diabetic ulcers, and even wounds in open fractures.[1,6-9] Multiple studies[1,6,7] have concluded that NPWT is an effective treatment method, decreasing the time of healing and possibly decreasing the need for future amputations. There is also evidence for improvement in bacterial counts with NPWT.[8] Vuerstaek and Vainas[6] found that wound VAC therapy also significantly decreased the subjective pain scores at follow-up.

The medical literature has shown NPWT to be effective in healing extremity wounds. Most described cases, however, have involved distal wounds. In the present case, NPWT was used in a proximal wound with extremely large tissue deficit. The key clinical assessment in the present case was the solid bone stock seen on examination. Also important was the wound VAC therapy's ability to stimulate soft-tissue repair.

Conclusion

We recommend the use of NPWT as an alternative to additional surgical treatment in complicated above-the-knee amputation wounds.

References

1. Armstrong DG, Lavery LA; Diabetic Foot Study Consortium. Negative pressure wound therapy after partial diabetic foot amputation: a multicentre, randomised controlled trial. *Lancet.* 2005;366(9498):1704-1710.
2. Granata JD, Philbin TM. Distal tibiofibular bone bridging in transtibial amputation. *Curr Orthop Pract.* 2010;21(3):264-267.
3. Steen PA, Michinfelder JD. Neurotoxicity of anesthetics. *Anesthesiology.* 1979;50(5):437-455.
4. Sheppeard H, Cleak DK, Ward DJ, O'Connor BT. A review of early mortality and morbidity in elderly patients following Charnley total hip replacement. *Arch Orthop Trauma Surg.* 1980;97(4):243-248.
5. Richter KJ, Hurvitz EA, Giradot K. Rigid removable dressing in a case of poor wound healing. *Arch Phys Med Rehabil.* 1988;69(2):128-129.
6. Vuerstaek JD, Vainas T. State-of-the-art treatment of chronic leg ulcers: a randomized controlled trial comparing vacuum-assisted closure (V.A.C.) with modern wound dressings. *J Vasc Surg.* 2006;44(5):1029-1037.
7. Frykberg RG, Williams DV. Negative-pressure wound therapy and diabetic foot amputations. *J Am Podiatr Med Assoc.* 2007;97(5):351-359.
8. Morykwas MJ, Argenta LC, Shelton-Brown EL, McGuirt W. Vacuum-assisted closure: a new method for wound control and treatment: animal studies and basic foundation. *Ann Plast Surg.* 1997;38(6):553-562.
9. Fleischmann W, Strecker W, Bombelli M, Kinzi L. Vakuumversiegelung zur behandlung des weichteilschadens be offenen frakturen [in German]. *Unfallchirurg.* 1993;96(9):488-492.