Connecting Multiple Open Wounds to a Single Negative-Pressure Dressing

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Abstract

We present a new technique for connecting open wounds to a negative-pressure device. In this technique, a flexible, small-diameter intravenous tube is used to bridge the gap between open wounds on the same extremity. After these connections are made, the first layer of plastic is placed, and only 1 fenestrated connection is made to the device. This technique allows use of multiple sponges with only 1 fenestrated cap and 1 connection to the device. The smaller intravenous tube must not be placed directly on skin, as it may cause a pressure ulcer underneath.

Negative-pressure devices that assist with wound closure were made commercially available in 1995, and their use was first reported in the French literature in 1996.[1] Since their introduction, these devices have increasingly been used in orthopedics. Herscovici and colleagues[2] recently found them to be valuable adjuncts in the treatment of high-energy soft-tissue trauma. In their nonrandomized clinical study, they used negative-pressure versus standard dressing changes in 21 patients who had sustained high-energy trauma. Fifty-seven percent of these patients did not require further treatment or split-thickness skin graft after approximately 20 days of negative-pressure treatment. Therefore, it has been established that negative closure can dramatically reduce the need for further costly and complex treatment.

In this article, we describe a new technique—using a single tube to connect open, complex wounds to a negative-pressure device. Although it may seem obvious that several tubes can be connected to the main vacuum, or Y-connectors can be used in similar fashion, the benefit of this original technique is that fewer tubes are required—which can be important when supplies are limited. To ensure that adequate pressure is achieved during treatment of this complex injury, we obtain pressure measurements.

> "...we created a low-resistance fenestrated tube that aided the negative-pressure device in removal of debris and edematous fluid."

Negative-pressure devices are useful in treating continuous wounds—the sponge can be cut into a variety of shapes—but what can be done for wounds that are noncontinuous? A connector is usually attached to the main sponge and then to the vacuum device, but in many cases the wound is complex and involves different sites on the limb.

In a motorcycle crash, a man's distal tibia sustained extensive soft-tissue damage. This degloving injury involved open, grade 3B tibial and medial malleolus fractures; navicular, talar, and third to fifth metatarsal head fractures; and a Lisfranc fracture. The

Figure 1. Initial irrigation and débridement of wound.

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Figure 2. Avoid placing intravenous tube directly on skin.

Figure 3. Results 1 month after injury

exposed distal tibia and loss of soft tissue along the posterior aspect of the ankle can be seen in Figure 1.

At initial irrigation and débridement, the patient was placed in a negative-pressure device to assist with temporary soft-tissue coverage. Placing the sponge over the entire wound allowed for better approximation of the wound edges once compressed. Often there are wounds that appear to be less extensive at the surface, but underneath intact skin there may be communicating tunnels that will delay wound healing. If these tunnels are not incorporated into the compressed sponge, healing will be delayed, as negative-pressure devices remove debris and fluid from the extravascular space, which decreases edema throughout the entire wound.[1] The sponge should be placed over the entire wound, whether or not communication tunnels are present. However, applying only 1 fenestrated connection over various open wounds is technically challenging.

To connect all wounds to a single system, we devised a method of using a small intravenous tube. In our patient's case, to connect the smaller areas to the main area housing the original fenestrated connection, we applied the single tube over each sponge, and this tube ultimately led to the vacuum device. In the tube over each sponge, small slits were cut to assist flow of fluid from the smaller wounds. We had to ensure that the plastic tube did not come into contact with the skin (Figure 2), as such contact may create a pressure ulcer once the vacuum is compressed. If keeping the tube away from the skin proves difficult, the surgeon may use a piece of the sponge to bridge the gap over the skin.

In essence, we created a low-resistance fenestrated tube that aided the negative-pressure device in removal of debris and edematous fluid, which would otherwise hinder wound healing. The device, connected to its own container for suction, was changed biweekly. After initial placement of the device, our patient did not require additional irrigation and débridement. He was given cefazolin and gentamicin after surgery. We noted no complications (specifically, tube clogs) while using this innovative device. The severity of his injuries and the need to use a split-thickness skin graft led to a hospital stay of 46 days. Vacuum therapy was discontinued after 31 days. By that time, the negative-pressure dressing had significantly reduced the wound, and the patient was able to receive the split-thickness skin graft for complete coverage. At only 1 month after injury, the results were dramatic (Figure 3).

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