A Novel Technique of Vacuum-assisted Wound Closure That Functions as a Delayed Primary Closure

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Abstract and Introduction

Abstract

Contaminated midline abdominal wounds are often left open and allowed to close via secondary intention to prevent surgical site infections. Negative pressure wound therapy (NPWT) devices have decreased time of healing by secondary intention when compared to the prior standard of moist dressings. The authors report a modification of NPWT that utilizes the unique characteristics of the negative pressure system to achieve delayed primary closure while preventing surgical site infections by continuously draining the wound effluent.

Introduction

Contaminated midline abdominal wounds are often left open and allowed to close by secondary intention to prevent surgical site infections. Negative pressure wound therapy (NPWT) devices have been shown to decrease time of healing by secondary intention when compared to the prior standard of moist dressings. A modification of NPWT that utilizes the unique characteristics of the NPWT system to achieve a delayed primary closure while preventing surgical site infections by continuously draining the wound effluent is presented.

Materials and Methods

The proposed technique of NPWT, specifically vacuum-assisted delayed primary closure (VADPC), uses the same materials as the vacuum-assisted closure (V.A.C.®Therapy™, KCI, San Antonio, Tex). A commercially available kit (KCI) was used that included a polyurethane foam, tubing, and an adhesive drape. The suction pump was rented from KCI. Proper wound selection is important for VADPC. The most appropriate wound for this technique is free of gross infection, devoid of necrotic debris, and has adequate perfusion. The patient's nutritional status must be sufficient to promote new tissue growth. The VADPC is designed for simple, subcutaneous wounds. This technique is not appropriate for wounds with fascial dehiscence as the tension is applied only to the skin and would not provide fascial approximation. Wounds the authors have selected for this type of closure include: 1) laparotomy incisions with the skin left open following contaminated or dirty procedures; and 2) secondarily opened laparotomy wounds or cesarean section wounds resulting from a superficial wound infection. This technique can be used in both thin and obese patients. The skin around the wound is cleaned with an antiseptic and shaved if necessary. An adhesive solution is applied to the skin around the wound, and the adhesive drape is attached to one side of the wound and traction is applied to approximate the skin edges. This initial drape should extend at least 6 cm from the wound edge on each side. The adhesive drape is perforated with the tip of a scalpel every 2 cm to 3 cm along the length of the wound. The polyurethane foam is placed over the drape covering the entire length of the wound and extending out approximately 4 cm to 6 cm on each side, but not past the drape. Another adhesive drape is then placed over the foam covering the entire initial drape. The suction tubing is applied in the usual fashion. The pump is set to -125 mmHg of continuous suction. The dressing is left in place for 5 days to allow for tissue adhesion. After 5 days the dressing is removed parallel to the direction of the wound after releasing the suction to avoid pulling the skin edges apart. The dressing can be reapplied and any areas left open on the initial application can be approximated at this...
time. Alternatively, if healing is adequate, the dressing can be left off and the wound supported with Steri-
Strips™ (3M Health Care, St. Paul, Minn) to prevent dehiscence. A schematic view of the dressing application is shown in Figure 1.

![Schematic view of the VADPC technique. The perforations are placed in the first adhesive drape after the wound edges are approximated.](image)

**Figure 1.**

Schematic view of the VADPC technique. The perforations are placed in the first adhesive drape after the wound edges are approximated.

## Results

The VADPC technique combines the advantages of delayed primary closure (faster wound healing and less scarring) with that of healing by secondary intention (low risk of wound infection) in a select set of patients. The observed benefits are 1) faster time to closure than secondary intention with or without standard NPWT, 2) improved cosmetic result when compared to closure by secondary intention or delayed primary closure, and 3) reduced pain. The case shows the wound of a 30-year-old woman on postoperative day (POD) 1 after a laparotomy for drainage of an intra-abdominal abscess (Figure 2). The wound was intentionally left open to prevent a surgical site infection, and her fascia was closed with a running suture. The VADPC was applied to the superior half of the wound on POD 1. The inferior half of the wound had the polyurethane foam placed in the wound, which is the standard application (Figure 2A, B). On POD 5, the VADPC was reapplied to the entire wound and the patient was discharged home (Figure 2C). The patient underwent 2 additional 5-day cycles of VADPC treatment. The patient's wound was closed on POD 15 and required no other wound care products (Figure 2D).
Figure 2.

A) POD 1: The wound following a contaminated laparotomy. B) VADPC applied to close the superior portion of the wound with foam dressing placed directly in the inferior portion. C) POD 5: The superior aspect of the wound is closed. D) POD 15: Complete closure.

Discussion

The observed benefits of VADPC are likely due to the constant drainage of contaminated wound effluent which has been reported to contain inhibitory factors as well as a large bacteria load that interfere with wound healing. The avoidance of suture or staples can improve the cosmetic outcome because under tension they can concentrate the spreading force of a large wound edge to small points along the wound. These tension points created by the suture or staples cause ischemia and possible necrosis of the tissue leading to "railroad tracks" along the length of the wound. This technique distributes the tension evenly along the wound avoiding pressure points and prevents the larger scar that is seen with healing by secondary intention. Other skin tensioning devices serve to bring the wound edges into apposition; however, they do not allow for or encourage the removal of contaminated or inhibitory wound effluent. The authors do not have direct experience utilizing such wound tensioning devices in a similar manner, but believe that they would have a less salutary effect because of the lack of continuous drainage. VADPC not unlike standard delayed primary closure also has the advantage of decreasing healing time compared to healing by secondary intention with or without NPWT.

Conclusion

To date, this method has not been reported in the medical literature. The authors hope this report will serve other clinicians well in their search for a better wound closure technique. However, further research to directly compare the VADPC to the standard NPWT dressing is necessary to allow for a firm conclusion as to the utility of this approach.

References

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