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REVIEW ARTICLE

Vacuum-assisted closure Dressing in Spine: An Emerging Trend

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ABSTRACT

Vacuum-assisted closure (VAC) is a negative pressure therapy for the closure of wounds as it accelerates secondary wound healing and may reduce the need of serial debridement. It is emerging as a therapy for the management of acute, sub-acute, and chronic wounds. As the number and indications of spine surgery have increased in the past 20 years, the number of complications has also increased. Wound infection is one of the most commonly encountered complications. Vacuum-assisted closure has emerged as a very cost-effective and alternative new technique for the management of dead space and wound conditioning in wound infection in spine. This article presents information about VAC and its studies with respect to the spine.

Keywords: Negative pressure therapy, Vacuum-assisted closure, Wound infection in spine.

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INTRODUCTION

Negative-pressure therapy or vacuum-assisted closure (VAC) was first described in 1989. It has been commercially available in the United States since 1995.[1,2]

Various treatment protocols for infection control, such as debridement, soft-tissue management, implant removal, and antibiotic therapy have been recommended. The use of wound VAC has gained increasing popularity in the management of acute, sub-acute, and chronic wounds. The controlled application of sub-atmospheric pressure helps the formation of granulation tissue, assists debridement of necrotic tissue, and acts as a sterile barrier.

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Increasing use of the VAC system for complex soft-tissue injuries[1,3-6] has generally resulted in accelerated wound healing compared with traditional methods.

In VAC therapy, the control level of negative pressure (vacuum) application removes blood and serous fluid, reduces infection rates, and increases localized blood flow, thereby supplying the wound with oxygen and nutrition to promote accelerated healing.

Two broad mechanisms of action of negative pressure therapy were proposed:

1. Fluid removal encompasses two beneficial effects in the process of wound healing. First is decrease in edema, leading to a decrease in interstitial pressure and diffusion distance, and the second is the removal of soluble factors, such as cytokines, collagenases, and elastases, which are primary inhibitors of fibroblasts and endothelial cell proliferation – essential to proper wound healing.
2. Mechanical deformation and increased growth, as it is the basis of tissue expansion.

An altered wound environment promotes increased blood flow and oxygen tension, decreased bacterial counts, and increased granulation tissue formation, resulting in improved wound healing by promoting expression of growth factors and angiogenesis.

MATERIALS AND METHODS

The clean open wound (after proper debridement of infected wound) is covered with one layer of paraffin gauge dressing, and a sterile polyvinyl-alcohol sponge of pore size 200 to 400 µm, slightly smaller in diameter than the wound itself, is then placed over the paraffin gauge dressing. A wide-caliber evacuation tube is placed above the sponge, after making a few holes at the distal end with scissors. A second sponge layer then covers the tube, and the whole area is sealed with adhesive drape extending approximately 5 cm beyond the margins of the wound, thus creating an air tight seal (Figs 1 and 2). The proximal end of the tube is connected to a wall-suction container, and the system is then placed under negative pressure at 50 to 200 mm Hg continuously for 1 to 3 days depending on the wound and discharge characteristics.

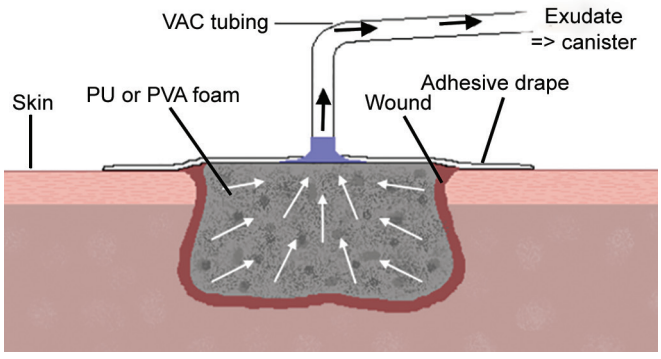

Fig. 1: Schematic diagram showing a cross-section of wound with VAC dressing

Fig. 2: Clinical picture of VAC application at lumbosacral region

DISCUSSION

Vacuum-assisted closure is an emerging new therapeutic technique for promoting the healing of infected wound resistant to treatment by established methods. Various treatment protocols like debridement, soft-tissue management, and antibiotic therapy have been recommended with mixed results. The use of the wound VAC system has gained increasing popularity in the management of acute, sub-acute, and chronic wounds. The controlled application of negative pressure helps the formation of granulation tissue, assists debridement of necrotic tissue, and acts as a sterile barrier. Increasing use of the VAC system for complex soft-tissue injuries[1,3-6] has generally resulted in accelerated wound healing compared with traditional methods.

Armstrong and Lavery[7] observed that the use of negative pressure therapy resulted in an increased rate of granulation tissue formation and a higher proportion of healed wounds compared to saline gauze dressings.

Mooney et al[3] reported successful results in children with extensive and complex soft-tissue wounds. There were fewer dressing changes and potentially less-extensive skin cover procedures. The use of the VAC system is particularly appealing in patients with multiple comorbidities since it may avoid the need for complex plastic surgery and later re-operation.

Mehbod et al[4] reported successful results using this system in the management of deep spinal infection in adults. They studied a heterogeneous group of 20 patients, of whom 16 had early- and 4 late-onset infections. Their patients had many risk factors like age, diabetes, smoking, tumor, or immunodeficiency with a short mean follow-up of 10 months.

Picada et al[8] using a protocol of aggressive debridement and delayed primary or secondary closure achieved eradication of infection in 24 of 26 adult patients with deep infection after lumbosacral fusion.

The VAC system has been widely used in the adult population (Table 1) with decrease in wound complications (Table 2), improved healing times, and reduced overall morbidity (Table 3). Application of

Table 1: Indications

Indications
• Inflammatory/pressure ulcers, i.e., scleroderma, systemic lupus erythematosus, hypercoagulable state, rheumatoid arthritis, vasculitic condition
• Pressure sores
• Highly exuding ulcer
• Ulcer where dressing stabilization is difficult
• Wound requiring skin graft or flap
• Burns
• Extravasation injury
• Spinal cord injuries
• Osteomyelitis

Table 2: Complications

Complications
• Bleeding
• Infection
• Enterocutaneous fistula
• Fluid depletion
• Pain
• Tearing of thin skin
• Skin irritation

Table 3: Advantages

Advantages
• Reduced frequency of dressing changes, thus reducing nursing time for wound care and increasing patient comfort
• Reduced length of hospital stay
• Reduced bacterial cell count
• Promotes robust granulation tissue by increasing dermal perfusion (blood flow to the wound)
• A controlled fashion to decrease wound volume
• Allow tissue decompression by removing interstitial fluid
• Improvement in adherence (e.g., with offloading)
• Control of odor and exudate in many wound types (i.e., social benefits) with less-frequent dressing changes
• Able to participate in daily living activities, physical therapy, and rehabilitation
• Faster return to reduced dependency and normal living

Table 4: Contraindications

Contraindications
• Malignancy in the wound
• Untreated osteomyelitis
• Non-enteric and unexplored fistula
• Necrotic tissue with eschar present
• Sensitivity to sliver
• Direct application on exposed nerve, blood vessels, and anastomotic sites and organ

negative pressure over the wound bed allows the arterioles to dilate, increasing the effectiveness of local circulation and promoting angiogenesis, which assists in the proliferation of granulation tissue.

Colonization of a wound, corresponding to a level of >100,000 colonies of bacteria per gram of tissue, has been recognized as a detrimental factor in the process of wound healing. The VAC therapy enhances bacterial clearance, which may account for the wound healing effects. Inappropriate and incorrect use (Table 4) will result in a non-healing wound and pain and discomfort to the patient.

In conclusion, the VAC technique is a useful tool in for the spinal surgeon dealing with patients susceptible to wound infections. It allows for retention of the instrumentation and maintenance of the spinal correction with effective control of infection. It is reliable, easy to use, and well reproducible.

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