Negative Pressure Wound Therapy for Burns

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KEYWORDS

• Negative pressure wound therapy • Burns • Skin graft • VAC

KEY POINTS

- The use of NPWT is associated with improved outcomes in a wide variety of complex wounds. Existing data support certain uses of NPWT for burn care, although studies are limited.
- Studies on the use of NPWT for acute burns suggest that NPWT may have a role in reducing edema and pain, and a positive effect on tissue perfusion and re-epithelialization.
- Of all potential applications of NPWT in burn care, using NPWT as a skin graft bolster dressing has the most supportive data. Other potential applications include management of extent of injury in acute burns, preparation of wound beds for skin grafting, and dressing skin graft donor sites. The use of modified NPWT dressings has shown promise in treating large burns.
- More scientific and clinical studies are needed to fully understand the mechanism of action, optimal method, and ideal applications for NPWT in burn patients.

INTRODUCTION

Negative pressure wound therapy (NPWT) has been used in the treatment of acute and chronic wounds for almost 20 years and is now widely used around the world. Although further research is required to specifically validate many of these treatments and to determine cost-effectiveness, existing data support the use of NPWT for certain aspects of burn care. Of all potential applications of NPWT in burn care, using NPWT as a skin graft bolster dressing has the most supportive data. Other potential applications include using NPWT to limit the extent of injury in acute burn wounds, as a bridge to skin grafting, and as a dressing for skin graft donor sites. This article reviews the literature based on application and describes our center's experience with extra-large (XL) NPWT dressings for large burns.

CLINICAL EVIDENCE ACCORDING TO INDICATION/APPLICATION

Management of Acute Burns with Negative Pressure Wound Therapy

The application of NPWT in the acute management of burn wounds was studied in hand burns by Kamolz and colleagues.[1] The goal when treating a burn acutely is to create a healing environment that protects against fluid losses, infection, and most importantly prevents further progression of the burn wound. Kamolz and colleagues[1] tested whether NPWT is better at this than conventional silver sulfadiazine cream in patients with bilateral partial-thickness hand burns who presented within 6 hours. Seven patients were used in this study with the conventional silver sulfadiazine treatment being used on the less severely burned hand. The primary outcome measure was perfusion to the

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injured skin as measured by indocyanine green angiography. The authors reported that perfusion was significantly improved on Day 3 in the burn wounds treated by NPWT. They also noted reduced edema and decreased progression of the burn wound on clinical examination of the NPWT-treated sites. Although this study was small (seven patients, 14 hands), it suggests that NPWT may have a role in preventing burn progression by improving microcirculation in the reversible zone of stasis.[1]

Beyond altering the microenvironment of the acute burn wound, NPWT may also be useful in the broader context of managing acutely ill burn patients. Banwell and Musgrave[2] have suggested that burns be treated in the acute phase with NPWT and that it is of particular benefit in clinically unstable patients for two reasons. First, full coverage of the burn (which might include complex operative procedures) may be delayed if patients are receiving treatment in intensive care. Second, it may be difficult to change dressings frequently in unstable patients, and NPWT can dramatically reduce the frequency of dressing changes. Thus, in addition to the direct benefits of limiting inflammatory injury in the microenvironment of the burn, NPWT can serve as a practical temporizing measure to achieve control of large wounds until patients become physiologically stable.

A prospective, randomized trial is needed to examine the effectiveness of NPWT in preventing progression of burn wounds, and its cost-effectiveness in management of acute burn wounds in critically ill patients.

Negative Pressure Wound Therapy as a Bridge to Skin Grafting

After the acute phase of burn injury and resuscitation, the second step is excision of devitalized tissue and coverage with skin grafts, when possible. The success of skin grafts depends on several factors, including the quality of the recipient wound bed. A well-vascularized bed with a low degree of bacterial colonization maximizes the probability of skin graft take. As such, NPWT use has been suggested as a method to prepare a wound to accept a skin graft. Although there are no good data on the use of NPWT in the preparation of burn wounds, there have been favorable studies looking at other types of open wounds. In addition to several retrospective studies,[3,4] a prospective randomized trial by Saaiq and colleagues[5] reported using NPWT versus wet-to-dry saline gauze to prepare traumatic wound sites for tie-over bolster skin grafting 10 days after debridement. The authors found that the patients treated with NPWT had a higher skin graft take and shorter hospital stays.

Negative Pressure Wound Therapy as a Bolster Dressing for Autografts

Scherer and colleagues[6] reported the results of a retrospective study where traditional skin graft securing methods were compared with NPWT in a variety of wounds, 50% of which were burns. A subgroup analysis of the burn wounds showed a decreased graft failure rate in the NPWT group (0% vs 19%).[6]

A randomized, double-blind control trial compared the total area of skin graft loss for skin wounds (of which more than half were burns) in grafts secured with conventional methods and NPWT.[7] The authors reported a median graft loss of 0.0 cm^2 (range, 0.0–11.8 cm^2) for the NPWT group, whereas the control group median graft loss was 4.5 cm^2 (range, 0.0–5.2 cm^2; $P = .001$). The patients treated with NPWT also had significantly shorter hospital stays.

A prospective randomized control trial by Petkar and colleagues[8] of 30 burn patients compared the graft take in 21 burn wounds receiving NPWT on the split-thickness skin graft (STSG) and 19 burn wounds receiving conventional compression dressings on the STSG. They found that mean graft take was higher in the NPWT group than in the control group (96.7% vs 87.5%; $P<.001$). Most studies have not examined the use of NPWT as a bolster in exclusively burn patients. However, the previously mentioned studies all report that NPWT likely improves graft take but at a higher financial cost.

Negative Pressure Wound Therapy as a Dressing to Integrate Bilaminate Dermal Substitutes

NPWT may have a role in the integration of a bilaminate dermal substitute in a burn site, such as Integra® (Integra LifeSciences Corporation, Plainsboro, NJ). Jeschke and colleagues[9] compared the use of conventional compression dressings versus NPWT with fibrin glue changed every 4 days to secure a bilaminate dermal substitute. Once the dermal substitute had fully vascularized, an STSG was placed and the STSG take rate as a percentage of total area of dermal substitute placement was recorded. The STSG take rate was significantly higher in the NPWT plus fibrin glue group compared with conventional pressure dressings (98% vs 78%; $P<.003$) with a shorter time to definitive coverage (10 days vs 24 days;