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Role of Closed Incision Negative Pressure Therapy in Scar Management

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Abstract

In recent years, there has been a greater emphasis on providing high-quality medical treatment to ensure patients' safety through improving recovery after surgery (ERAS), reducing postoperative stress, and restoring normal function quickly. Negative pressure wound care has revolutionized the way acute and chronic wounds are treated. The incision site is usually covered with an occlusive or semi-occlusive covering after primary wound closure. It is thought that using closed incisional negative pressure therapy on surgical wounds improves wound healing by better distributing shear stresses on wound edges and promoting the evacuation of wound fluids such subcutaneous seroma and hematoma.

Keywords: Closed incisional; Negative pressure therapy; Scar.

Introduction

Negative pressure wound care has revolutionized the way acute and chronic wounds are treated.[1,2] The incision site is usually covered with an occlusive or semi-occlusive covering after primary wound closure. The benefits of closed incisional negative pressure therapy (ciNPT) on surgical wounds after vascular surgery, hip replacement, or amputations have been proven in several investigations.[3-5] It is thought that using ciNPT on surgical wounds improves wound healing by better distributing shear stresses on wound edges and promoting the evacuation of wound fluids such as subcutaneous seroma and hematoma.[6-8] Furthermore, ciNPT minimizes wound dehiscence and the possibility of entering germs through its protective sealing.[6] This study aimed to investigate the impact of ciNPT on donor site healing and scarring. We hypothesized that ciNPT might have beneficial effects on donor site healing, scarring, and patient reported esthetic scar appearance.

Material and Methods

This study was conducted in the Department of Plastic surgery in a Tertiary care center in South India. Departmental ethical clearance and consent from the subject were obtained. The details of the patient in study are as follows: 40 year old male (known diabetic) with history of left lower cellulitis for which he underwent debridement and subsequent split-thickness skin grafting; now has small residual 1.5x1cm raw area (figure 1). The epidermal graft was taken by using a size 15 blade and harvesting the epidermis alone. The harvested graft was applied into the raw area with the help of 2-octyl cyanoacrylate adhesive. The donor site was

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closed primarily (figure 1) and negative pressure therapy was applied over it (ciNPT) (figure 2).



Fig. 1: Donor site closed primarily.



Fig. 2: ciNPT applied after primary closure of donor site.



Fig. 3: Donor site at 3 weeks-minimal scar formation.

Results

The donor site healed completely with minimal scar formation (Vancouver scar scale score: 3) after 3 weeks post-operatively (figure 2).

Discussion

In recent years, there has been a greater emphasis on providing high-quality medical treatment to ensure patients' safety through improving recovery after surgery (ERAS), reducing postoperative stress, and restoring normal function quickly. Negative-pressure wound vacuum therapy (NPWVT) is a well-known treatment for infected or burst open surgical incisions. Its usage in closed surgical sites has recently become the topic of new investigation. In 2006, Gomoll et al. published their findings using a similarly modified incisional dressing, which was the first time NPWT was used on closed incisions (ciNPT).[12] Several NPWT mechanisms have been proposed.[9]

Macroscopic Effects of NPWT include: Shortens the time it takes to close a wound by creating and maintaining a moist wound environment; reduces oedema and seroma development in wounds; through macro deformation, it stimulates wound contracture; through a boosting effect, NPWT stabilizes mending tissues; provides both superficial and deeper healing tissues with opposing forces; reduces the size and intricacy of the wound while it heals.

Microscopic Effects of NPWT include: Increased expression of VEGF, IL-8 VEGF gradient increases toward the wound; vigorous angiogenesis in a parallel fashion, oriented toward the wound compared to fewer tortuous new vessels observed in controls; stimulates cell proliferation through micro-deformation; decreases local blood flow in those tissues in closest proximity to the ROCF; changes the colonizing flora of the wound, may increase or have no effect on overall bacterial load; increased neovascularization.

Siegwart et al. looked at the role of ciNPT in preventing abdominal donor site problems in 300 microsurgical breast reconstructions in a preliminary research. The authors discovered a considerable reduction in wound dehiscence after considering our findings.[10] ciNPT has been reported to be effective as a prophylactic treatment for the donor site of other flaps, where wound fluid collection is the primary cause of wound complications, allowing suction drains to be removed sooner. Experimental studies have shown that ciNPT reduces tension across the surgical incision, improving local blood flow and hence minimizing dead space and wound fluid collection.

The Vancouver Scar Scale (VSS) is a well-validated and well-established scale for evaluating hypertrophic scarring and scar quality, with a significant association to objective scar assessment techniques like the CutometerR.[11] However, there are a few limits to consider. The authors claim that combining ordinal (hypo-, hyper-, and mix-pigmentation) and numeric scales into a single score is impossible. They also don't make a clear distinction between "pigmentation" and "vascularity," as well as "contraction" and "pliability."

With regard to our study, we demonstrated that ciNPT is a cornerstone to improve scar quality and the esthetic scar appearance. As this a single case study, further large scale randomized control study is required to comment on its efficacy.

Conclusion

In summary, our results reveal a significant reduction in scar after ciNPT and a significant improvement in patient-reported scar quality at the donor site. We are also confident that the use of ciNPT can be a key contributor in reducing preventing hypertrophic scar formation donor site complications, accelerating patients' postoperative recovery.

Conflicts of interest: None

Authors' contributions: All authors made contributions to the article.

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