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Outcomes of Negative Pressure Wound Therapy for Degloving Soft Tissue Injuries around the Foot and Ankle

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Introduction: Main aim of the study was to evaluate the results of negative pressure wound therapy (NPWT) in patients with open wounds in the foot and ankle region.
Materials and Methods: Sixteen (16) patients with degloving injuries arounf the foot and ankle admitted in VS general hospital were treated with negative pressure wound therapy. Amongst all the patients admitted with degloving injuries the mode of injury were the following like acute trauma, due to a traffic accident, a fall, or a crush injury, and all had wounds with underlying tendon or bone exposure. All the degloving wounds were thoroughly debrided and irrigated before Negative pressure wound therapy was applied. Dressings were changed every 3 or 4 days and treatment was continued for 18.4 days on average (range, 11–29 days).
Results: Fifteen (15) cases out of 16 developed granulation tissue in their wounds after treatment with negative pressure wound therapy. The sizes of degloving wounds reduced from 27 cm to 15 cm after NPWT. Amongst 15 cases were granulation tissue was formed in degloving wounds a skin graft was used to cover them and in one case. A free flap was needed to cover exposed bone and tendon in one case. No major complication occurred that was directly

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attributable to treatment. Amongst the patients who underwent skin grafting 2 patients developed scar contracture.

Conclusion: Thus from the above obtained observations it is concluded that negative pressure wound therapy promotes granulation of the open degloving wounds, fastens the healing process and thus reduces the healing time and saves the patient from secondary reconstructive procedures.

Keywords: Negative pressure wound therapy; degloving injuries; foot and ankle; bone and tendon.

1. INTRODUCTION

After foot and ankle trauma as the bones are superficial bones and tendons get easily exposed and causes much morbidity in terms of healing [1] Traditional method of treating such injuries is wet dressing which forms the granulation tissue but this is a prolonged procedure and requires skin grafting after that [2]. However, the duration of treatment may be prolonged, and patients may experience severe pain during dressing changes [3]. Also the formation of granulation tissue is a lot more difficult task after dressing and takes a lot more time [4].

Argenta and Morykwas [2] first introduced the concept of negative pressure wound therapy. Main mechanism through which the negative pressure wound therapy works is creating a continuous negative vaccum pressure which reduces oedema and improves blood supply thus promoting the formation of granulation tissue. Several studies have been issued on the application of NPWT to soft tissue defects of the extremities [5,6].

The main objective of the study is to evaluate the results of negative pressure wound therapy on degloving wounds of foot and ankle with exposed bone and it substantially reduces the need for flap surgeries.

2. MATERIALS AND METHODOLOGY

This study was carried out on 16 patients admitted in vs General hospital with degloving inuries around foot and ankle over the period of two and half years between 2015 to 2018. Average age of patients was 28 years. Mode or mechanism of injury was Road traffic accident in 12 and crush injury in 4 patients . Wound were located on the medial side of the ankle in 3 cases, the lateral side of the ankle in 1 case, and of the dorsum of the foot in 12 cases. All the patients admitted with degloving injuries and included in study had bones and tendon exposed.

3. PROCEDURE

All the degloving wounds were thoroughly cleansed and debrided before negative pressure and was done in operating room therapy was applied because the bacterial load of the wound must be minimum before it is applied and it is contraindicated in acute infections. The NPWT apparatus consist of polyurethane spone applied on the wound, connecting tube and a vaccum pump to create a negative pressure. The sponge, which was designed to be 3–5 cm larger than wounds, was applied to defect sites and sealed with transparent cohesive film. The procedure of NPWT was repeated 3-4 times depending upon the wound. However, when necessary, debridement was performed in an operating room. 120 mm hg negative pressure was created for every wound in this study. The procedure was repeated every 4 days until the wounds were covered with red granulation tissue. After the wounds were granulated they were covered with skin grafts.

Sizing of the wounds were done before and after the therapy. Wounds were categorized into 5 groups based on degree of exposure and the presence of concomitant infection, which was graded from 0 to 4 (Table 1). Final coverage techniques, including primary closure, split thickness skin grafting, and pedicled local and vascularized free flap grafting were documented. Furthermore, any complications attributable to NPWT treatment were noted [7].

Table 1. Showing grades of wound

Score	Status of the wound
0	Closed injury
1	Skin or soft tissue defect
2	Bone,tendon,implant exposure(any 1)
3	Bone,tendon,Implant exposure(any 2)
4	Superadded infection

4. OBSERVATIONS

The therapy of negative pressure was continued till wounds were granulated and lasted for an

average of 6 weeks and therapy was repeated 5 times on an average. Wound size before therapy was 27 cm and was reduced to15 cm after therapy. 15 cases amongst 16 cases were successfully granulated as shown below which were skin grafted (Fig. 1). After NPWT, skin grafting was performed to cover granulation tissue in 15 cases (a split-thickness skin graft in 14 cases and a full-thickness skin graft in 1 case)one out of 16 cases was a failure to therapy and did not show any granulation tissue and in such case flap was done. The average wound grade was 2.69 at the start of treatment, and 1.13 at the end of treatment.

5. DISCUSSION

Degloving injuries around the foot and ankle are associated with significant mortality and morbidity due to prolonged dressing which are non compliant and are associated with skin loss, bone exposure and infections. When there is associated diabetes and peripheral vascular disease the prognosis of these wounds can still be worse due to loss of blood supply. The rapid formation of granulation tissue and blood vessels are essential for the healing of these wounds. Simple wet and gelatin dressings used for treatment of such wounds can be cumber some and require to be changed frequently in a day which is very time consuming and unfruitful [8]. In addition, interstitial fluid leaked from open wounds reduces local blood supply and disturbs wound healing due to its collagenase and metalloproteinase constituents [9,10] In such context Negative pressure wound therapy due to its continuous vaccum effect sucks all the interstitial fluid from the wound and promotes wound healing and rapid formation of granulation tissue over the wound. DeFranzio [5] also reported that NPWT enhances rapid granulation formation in over 80% of patients as compared with a simple wet dressing. Due to the continuous negative vaccum created by it this therapy provides a constant stimulus for the formation of granulation tissue over the wounds [11,12].

In a comparative study between traditional dressings and negative pressure wound therapy [13,14] the continuous negative pressure wound therapy reduces the need of flap surgeries by 20 percent. A remarkable reduction in the requirement for secondary soft tissue operation is believed to be a big advantage of NPWT [15]. A study conducted by Dedmond [16] in open wounds wounds of grade 3 with an accompanying open tibial fracture healed without the need for a secondary soft tissue operation, such as, a free flap. Thus negative pressure wound therapy substantially reduces the need for flap reconstruction and secondary surgeries.

Fig. 1. Photograph showing different types of wounds

Also in septic and infected wounds simple wet dressings are inefective but in such type of wounds NPWT by creating a continuous negative pressure removes all the hematoma, debris,and necrotic materials thus it promotes wound healing and eradicates the chances of sepsis and has a dual role [16,17,18]. Furthermore, it has been reported that NPWT is effective in treating deep infections [19].

This study has several limitations that require consideration, namely, that the size of data is small, and there was no control group, which reduced objectivity

6. CONCLUSION

This study has demonstrated that NPWT therapy promotes rapid wound healing eradicates sepsis and reduces need of secondary flaps [20].

Our results add to growing evidence that NPWT is a useful adjunctive treatment for open wounds around the foot and ankle. In the present study, it was found to facilitate the rapid formation of granulation tissue, to shorten healing time, and to reduce remarkably the need for additional soft tissue reconstructive surgery.

CONSENT AND ETHICAL APPROVAL

As per international standard guideline participant consent and ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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