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Original Research Article

A Comparative Study on Healthy Granulation Tissue, Absence of Slough, Wound Retraction After Intervention Between Negative Pressure Wound Therapy (NPWT) and Standard Chlorhexidine Gauze Dressing in Post-Traumatic Soft Tissue Defects in the Extremities

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Abstract:

Modern advances and super specialities in surgical disciplines can deal with these injuries in a combined and sophisticated manner. Secondary infection of the wound is a significant complication and will lead to complex complications which pose challenges in the line of treatment in the form of increased hospital stay, partial or complete failure of treatment, exposed implants and deep structures like tendons, nerves, and bone. Surgical options to reduce the chances of infection of the wounds include early coverage of wound in the form of flaps or skin grafts.

Keywords: NPWT, Graft.

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Introduction

Traumatic soft-tissue defects are not superficial but involve multi-structural tissue damage or loss of tissue when extremities are affected and rarely involve only the skin and the subcutaneous tissue.1 Various individual and institutional epidemiological studies report the incidence of open fractures to be 11.5 per 100,000 individuals, with an estimated 3.3% of all upper limb and 3.7% of all lower limb and 0.3% of limb girdle, fractures being open. Tibial fractures are open upto 21%, mainly because the soft tissue envelope is thinner when compared to other long bones.2 Modern advances and super specialities in surgical disciplines can deal with these injuries in a combined and sophisticated manner. Secondary infection of the wound is a significant complication and will lead to complex complications which pose challenges in the line of treatment in the form of increased hospital stay, partial or complete failure of treatment, exposed implants and deep structures like tendons, nerves, and bone.3,4 Surgical options to reduce the chances of infection of the wounds include early coverage of wound in the form of flaps or skin grafts. These surgical choices are made after thorough debridement. However, some wound related and patient related factors do not permit early coverage of these wounds. In these cases one has to consider alternative methods of managing the soft tissue defects in the primary set up. One of the available modality for managing soft tissue defects in the initial periods is Negative Pressure Wound Therapy.

Materials and Methods

Patients with post traumatic raw wounds without exposed bones, cartilages or other vital structures admitted to the department of orthopaedics.

Inclusion Criteria:

- Post traumatic wounds of thigh, leg, ankle, foot, arm, fore arm and hand
- Age: 18 years and above

Exclusion Criteria:

- Exposed bare bones, cartilages or other vital structures (blood vessels, anastomotic sites, organs or nerves)
- Chronic wounds, post-surgical, dehisced wounds, diabetic and neuropathic ulcers Patients with bleeding disorder or on anticoagulants

Wounds with slough which can't be completely debrided

Table 1: Size of Soft Tissue Defect (maximum length/ breadth in cms)

	Group A		Group B	
Size	**Number**	**Percentage**	**Number**	**Percentage**
<5 cm	4	20.00	6	30.00
6-10 cm	10	50.00	12	60.00
11-15 cm	6	30.00	2	10.00
Total	20	100.00	20	100.00

P = 0.2754 (NS) – chi-square test

In the present study 20% of the patients in group A were having wound size of <5cm compared to 30% in group B, 50% of the patients in group A were having wound size between 6cm & 10cm compared to 60% in group B and 30% of the patients in group A were having wound size between 11cm & 15cm compared to 10% in group B at the time of admission.

Table 2: Shape of Soft Tissue Defect

	Group A		Group B	
Shape	**Number**	**Percentage**	**Number**	**Percentage**
Oval	8	40.00	10	50.00
Circular	3	15.00	1	5.00
Irregular	9	45.00	9	45.00
Total	20	100.00	20	100.00

P = 0.5427 (NS) – chi-square test

In the present study 40% of the patients in group A were having oval shaped wounds compared to 10% in group B, 15% of the patients in group A were having circular wounds compared to 60% in group B and 45% of the patients in each group A and group B were having irregular wounds at the time of admission.

Table 3: Edge of Wounds

	Group A		Group B	
Edge	**Number**	**Percentage**	**Number**	**Percentage**
Attached	13	65.00	15	75.00
Non-attached	7	35.00	3	15.00
Rolled under	0	0.00	1	5.00
Fibrotic	0	0.00	1	5.00
Total	20	100.00	20	100.00

P = 0.2906 (NS) – chi-square test

In the present study 65% of the patients in group A were having edges attached to floor compared to 15% in group B, 35% of the patients in group A were having edges not attached to floor compared to 15% in group B, 5% of the patients in group B were having rolled under edges and 5% of the patients in group B were having fibrotic edges at the time of admission.

Table 4: Margin of Wounds

	Group A		Group B	
Margin	**Number**	**Percentage**	**Number**	**Percentage**
Regular	5	25.00	6	30.00
Irregular	15	75.00	14	70.00
Total	20	100.00	20	100.00

P = 0.7233 (NS) – chi-square test

In the present study 25% of the patients in group A were having regular margins compared to 30% in group B and 75% of the patients in group A were having irregular margins compared to 70% in group B at the time of admission.

Table 5: Base of Wounds

	Group A		Group B	
Base	**Number**	**Percentage**	**Number**	**Percentage**
Fascia	0	0.00	7	35.00
Soft tissue	20	100.00	13	65.00
Total	20	100.00	20	100.00

P = 0.0036 (VS) – chi-square test

In the present study 35% of the patients in group B were having base exposed up to fascia, 100% of the patients in group A were having base exposed up to soft tissues compared to 65% in group B at the time of admission. This difference was found to be statistically very significant.

Discussion

In the present study all forty patients were having unhealthy pale yellow granulation tissue at day 0. At day 5, seventeen out of twenty patients were having healthy red granulation tissue in NPWT Group compared to five out of twenty patients in chlorhexidine gauze dressing Group. At day 10, the remaining three patients were having healthy red granulation tissue in NPWT Group and thirteen out of fifteen remaining patients were having healthy red granulation tissue in chlorhexidine gauze dressing Group. At day 15, remaining two patients were having healthy red granulation tissue in chlorhexidine gauze dressing Group with P value less than 0.0001 (using chi square test) and this difference was considered to be extremely statistically significant. In a study conducted on 30 patients by Prabhdeep Singh Nain et. al it was observed that during the first week granulation tissue was absent in 4 patients (26.67%) in Group A (NPWT) and 10 patients (66.67%) in Group B (saline-moistened gauze). It was seen that granulation tissue appeared at 2nd week in three out of four patients (75%) and 4th week in the remaining 1(25%) patient in Group A. The appearance of granulation tissue in patients of Group B was at 2nd, 4th and 5th week in three (30%), 3(30%) and two (20%) patients, respectively. It was also noted that in two (20%) patients granulation tissue remained absent even at the end of observation period. This suggested early appearance of granulation tissue in patients of Group A which was also found to be statistically significant.5 In another study conducted on 54 patients by C.M. Moue¨s et. al it was found that in the vacuum-treated Group, 20 patients (69%) showed a healthy, granulating wound bed within 1 week compared to 14 (56%) in the conventionally treated Group. Within the next week, five more patients in the vacuum Group showed a clean, healthy wound bed (cumulative 86%) compared to seven in the conventionally treated Group (84%). In one vacuum-treated patient (3%) wound healing was slow and duration of therapy exceeded 14 days compared to three patients in the conventional Group (12%). Based on the visual aspects in combination with the formation of granulating tissue, healthier wound conditions were observed earlier in Group A compared to wounds in Group B.6 In 3rd study conducted on 162 patients by Armstrong DG, Lavery LA, the rate of granulation tissue formation, based on the time to 76-100% formation in the wound bed, was faster in the NPWT Group than in controls (p=0.002).7 In our study also it was found that rate of formation of healthy red granulation tissue was faster in the patients of NPWT Group as compared to chlorhexidine gauze dressing Group indicating NPWT is superior in development of red healthy granulation tissue in post traumatic soft tissue defects in the extremities. This supports the finding that NPWT has a positive effect on promotion of granulation tissue which is indication if improved vascularity.In the present study, six out of twenty patients in NPWT Group were having slough free wounds compared to thirteen out of twenty patients in chlorhexidine gauze dressing Group at day 0. At day 5, ten out of fourteen remaining patients (71.42%) in NPWT Group were having slough free wounds compared to four out of seven remaining patients (57.14%) in chlorhexidine gauze dressing Group. At day 10, remaining four patients and three patients were having slough free wounds in NPWT Group and chlorhexidine gauze dressing Group respectively and most commonly present organisms in culture were Staphylococcus aureus at the time of admission with P value less than 0.0001 (using chi square test) and this difference was considered to be extremely statistically significant. Reduction in slough is indication of reduction in the burden of nonviable tissue which is a prerequisite for planning definitive coverage of the wound. As per our awareness after complete search through available and updated literature, there are no studies on reduction of slough in the wound bed between NPWT and conventional dressings and our study is the first to demonstrate such a difference between NPWT and conventional dressing. In our study it was found that patients of NPWT Group showed rapid reduction in slough compared to chlorhexidine gauze dressing Group. This suggests that NPWT also plays a role in improving vascularity of wound and preventing further cell death.

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