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Original Research Article

A comparative study of vacuum assisted closure dressing with conventional dressings in the management of infected wounds

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ABSTRACT

Background: In the whole world including India, incidence of infected wounds is increasing day by day. Trauma is the most common cause of wounds and number of other factors contribute to wound infection there on. Wound management and care thus carry an important role for such patients in the form of dressings, debridement etc. Many conventional dressings are being used these days, but vacuum assisted closure (VAC) dressing as widely gained acceptance now.
Methods: Our study was conducted on 60 patients divided in 2 groups of 30 each to compare VAC dressing with conventional dressings.
Results: There was significant difference in total hospital stay, no. of debridement done, granulation tissue fill up and graft take up in both groups, for example, the average hospital stay in group A was 21.8±7.61 and in group B was 26.47±9.55.
Conclusions: So, VAC dressing was found to be more beneficial and patient friendly with lesser hospital stay and thus lesser cost than conventional dressings.

Keywords: Vacuum assisted closure dressing, Conventional dressings, Wounds

INTRODUCTION

Acute and chronic injuries are a significant cause of morb idity and poor quality of life. They affect a minimum of 1% of the population and represent a big risk factor for hospitalization, amputation, sepsis, and even death. The treatment of large wounds remains a significant challenge to practitioners, a cause of pain and discomfort to the patients, and is costly.[1-3]

The development of a wound infection depends on a complex interplay of many factors. If the integrity and protective function of the skin is breached, large quantities of various cell types will enter the wound and initiate an inflammatory response. The classic signs of redness, discomfort, swelling, elevated temperature and fever may characterize this. This process ultimately aims to restore homeostasis.[4]

The potential for infection depends on variety of patient variables like the state of hydration, nutrition and existing medical conditions also as extrinsic factors, for instance related to pre-, intra-, and post-operative care if the patient has undergone surgery. This also makes it hard to predict which wounds are going to become infected.[5] Consequently, for all healthcare personnel, the prevention of wound infection should be a key management priory.

The nosocomial infection national surveillance service (NINSS) 2002 survey report shows that the rate of surgical wound related hospital acquired infection (HAI) is as high as 10 percent. Such infections make illness more complicated, cause anxiety, increase patient discomfort and can cause death. The cost to the NHS per annum is almost £ 1 billion pounds.[6]

Infections of the surgical wound are one among the foremost common HAIs and are a crucial explanation

for morbidity and mortality. There are also economic implications of the delay in rehabilitation and subsequent extended hospital stay time. It has been estimated that every patient with a surgical site infection would require a further 6.5 days in hospital, which ends up with the doubling of hospital costs associated with that patient.[7]

Although wound dressings are being used for a minimum of two millennia, there exists no ideal dressing. Surgical dressings of both open and closed wounds are predicated mainly on tradition, training and therefore the surgeon's own philosophy. Modern wound-healing concepts include differing types of moist dressings and topical agents, although only a couple of these treatments have convincingly been shown to offer higher wound closure rates compared with traditional wet gauze dressings.[8-10] During the last 20 years a good sort of innovative dressings are introduced. Negative pressure wound dressing may be a new technology that has been shown to accelerate granulation growth and promote faster healing, thereby decreasing the amount of time between debridement and definite surgical closure in large wounds.

The locally made negative pressure dressing was an optio n in developing countries such as India, where the dressin g price could be a major concern. Clinical knowledge about the management of difficult-to-treat wounds remains limited due to the shortage of high-quality evidence.[11-14]

During an ideal wound care in addition to control the infection should also protect the normal tissues and must not interfere with the normal wound healing.

Over the years, different treatment modalities have been found in various form of wound dressings such as cream, ointments, solutions, while occlusive dressing, non-occlusive dressing, absorptive dressing, skin replacements, and negative vacuum dressing are other classes of wound dressings.[15]

The present study was conducted to determine the effectiveness of vacuum assisted closure dressings in enhancing the healing process in chronic wounds, as compared to normal moist wound dressings.

Hence the present study was done at our tertiary care centre to compare and evaluate the efficiency of vacuum assisted closure dressing and conventional dressings in the management of infected wounds.

METHODS

A hospital based prospective observational study was conducted in the department of surgery, SGRD Institute of medical sciences and research, Sri Amritsar from June 2018 to 2020.

All patients presenting with wounds and ulcers on upper or lower limbs in surgical OPD and emergency of SGRDIMSR, Sri Amritsar were included in the study.

The total number of patients admitted were 60. 30 cases got VAC dressing application and remaining 30 were managed with conventional dressings. These 60 patients were divided in 2 groups, group A and group B by odd-even randomization alternatively as per their presentation to the hospital in VAC dressings and conventional dressings respectively.

Inclusion criteria

Patients with age between 18-75 years, all types of chronic wounds irrespective of aetiology, diabetic ulcers/non-diabetic ulcers, wound site=limbs, chronic pressure ulcers, wound size=5 cm^2 and above, patients giving consent for vacuum therapy. Admissions were done in our unit between June 2018 to 2020.

Exclusion criteria

Untreated underlying osteomyelitis, Exposed Vessels, Wounds with unstable fractures or lose fragments of bone, Malignancy in the wound.

Members of the study group were selected consecutively as and when they presented to hospital applying inclusion and exclusion criteria.

History of the patient attending Sri Guru Ram Das institute of medical sciences and research, Sri Amritsar was taken personally from the patient.

A case record form was filled for each patient documenting age, sex, address and clinical information, including chief complaints, duration of symptoms, predisposing factors and any previous history of treatment. Other medical history like traumas, HTN, and TB etc. were also noted.

Patient, relatives, nursing staff, interns were explained about the procedure and trained to monitor, and to inform/take necessary steps in case of any problem, for example malfunctioning of vacuum apparatus etc.

VAC or conventional dressings were applied alternatively to the patients.

All patients underwent detailed clinical examination and relevant investigations and the wounds were thoroughly debrided and the ulcer dimensions as well as the surface area assessed. Before the start of VAC therapy, after initial debridement, the wound was photographed with a ruler placed beside the wound. A double layer of polyethylene sheets was held firmly in place over the wound, and an outline of the wound was traced using a permanent marker. The layer in direct contact with the wound was discarded. The tracing made on the top layer

of polyethylene was fixed against a graphic grid (2 x 2 mm), and its area was quantitated to measure the area of the wound to the nearest 4 mm^2. At subsequent VAC dressing changes, the wound was like wise photographed, and its area was quantitated using the double polyethylene sheet technique. Before surgical intervention at the end of VAC therapy, the final appearance of the wound was again noted and recorded. The patients were followed up on a daily basis in both test and control groups. The control group was subjected to twice-daily dressings by conventional methods whereas the test group was subjected to topical negative pressure dressings and was left undisturbed for 2 days and wound was inspected twice daily.

Materials used

The application of topical negative pressure moist dressings needs the following materials. They include-synthetic hydrocolloid sheet, vacuum suction apparatus and transparent semi permeable adhesive membrane sheet.

Technique of application The VAC dressing is a combination of composite synthetic hydrocolloid sheet dressing with vacuum assisted wound closure systems. The technique involves six steps. All the patients included in group A were subjected to these six steps. These were as follows: the wound was thoroughly debrided and devitalized tissue removed. A perforated drain tube was placed on top of the wound bed and other end was brought out a little away from main wound, the hydrocolloid foam dressing soaked in povidone iodine solution was cut to size of the wound and applied over the drain tube, the foam with the surrounding normal skin was covered with adhesive, semi-permeable, transparent membrane. A good air seal was thus ensured around the wound, distal end of the drain tube was connected to a device, which provided a negative pressure of 125 mmHg was applied to the wound, either continuously or intermittently (5 minutes “on”, 2 minutes “off”), this was achieved by wall suction apparatus, computerized devices or mobile suction drain devices. Suction was applied continuously or intermittently based on amount of wound discharge, once vacuum was applied, the foam was seen collapsed into the wound bed, thus giving the surface a concave appearance and the fluid from the wound was absorbed by the foam and was removed from the wound bed by suction.

The negative pressure was maintained for an average of 2 days for maximum benefit as studies have proved. Once adequate granulation tissue was formed the dressing was removed and definitive wound closure achieved by skin grafting. At the end of two days the wounds in both the groups were inspected after removal of the dressings from the test group. The wounds were compared based on the following parameters. They were, rate of granulation tissue formation (percentage of the ulcer surface area), quality of ulcer bed, present dimensions and surface area of the ulcer, once these parameters were assessed, both the groups were subjected to split thickness skin grafting. Both groups were given the same systemic antibiotics during the postoperative period. The wounds were reassessed at the end of the fifth postoperative day and the following parameters were accounted for. They were, -skin graft take up as a percentage of ulcer surface area-number of days of hospitalization After discharge, patients were followed up in the outpatient department after one month to assess post skin grafting complications like contractures, itching, pain and infection. The results obtained were statistically evaluated and the main parameters, which were analysed, were, rate of granulation tissue formation, graft survival and take up, duration of hospital stay and number of debridement needed.

The mean rate of granulation tissue formation, graft survival and hospital stay were calculated and compared for both groups.

Data analysis

Data from this study were systematically collected, compiled and statistically analysed using the SPSS Statistics-26 version to draw the necessary conclusions. The findings were tabulated as mean ± standard deviation in the form of (SD). The student t assay was used in parametric data. Using the Chi square test, quantitative variables were associated. The data was evaluated and the significance level was calculated with $p<0.05$ as significant and $p<0.001$ as highly significant as its 'p' value.

RESULTS

The mean age of the patients in group A was 50.83±18.76 years and in group B 51.7±15.1 years. There was no significant difference between the groups ($p>0.05$) as depicted in Table 1.

Table 1: Distribution of patients according to age.

Age (year)	Group A (n=30)		Group B (n=30)	
	N	%	N	%
≤20	1	3.3	1	3.3
21-30	5	16.7	3	10.0
31-40	4	13.3	2	6.7
41-50	5	16.7	9	30.0
51-60	5	16.7	4	13.3
61-70	5	16.7	8	26.7
71-75	5	16.7	3	10.0
Mean ± SD	50.83±18.76		51.7±15.1	
P value	0.844			

There was male preponderance in both the groups (83.3% and 80% respectively) while there were 16.7 and 20% female patients in group A and group B respectively.

There was no significant difference between the groups (p>0.05) as depicted in Table 2.

Table 2: Distribution of patients according to sex.

Sex	Group A (n=30)		Group B (n=30)	
	N	%	N	%
Male	25	83.3	24	80.0
Female	5	16.7	6	20.0
Total	30	100	30	100

18 (60%), 11(36.7) and 1 (3.3%) patients of group A underwent 0, 1 and 2 debridement respectively. 7 (23.3%), 21 (70%) and 2 (6.7%) patients of group B underwent 0, 1 and 2 debridement respectively. There was significant difference between the groups as per chi square test (p<0.05) as depicted in Table 3.

Table 3: Distribution of patients according to numbers of debridement.

Number of debridement	Group A		Group B		P
	N	%	N	%	
0	18	60	7	23.3	0.016
1	11	36.7	21	70	
2	1	3.3	2	6.7	
Total	30	100	30	100	

The mean duration of hospital stay in group A and group B was 21.8±7.61 and 26.47±9.55 days respectively. There was significant difference between the groups as per student t-test (p<0.05) as depicted by data in the Table 4.

Table 4: Distribution of patients according to duration of hospital stay.

Duration of hospital stay (day)	Group A		Group B		P
	N	%	N	%	
11-20	19	63.3	5	16.7	0.041
21-30	7	23.3	14	46.7	
31-40	3	10.0	9	30.0	
41-50	1	3.3	1	3.3	
51-60	-	-	1	3.3	
Total	30	100	30	100	
Mean ± SD	21.8±7.61		26.47±9.55		

The mean graft uptake of group A and group B was 94.3±5.99 and 90.97±6.2 respectively. There was significant difference between the groups as per student t-test (p<0.05) as depicted by data in Table 5.

The mean percentage of granulation tissue formation in group A was 93.23±5.03 and in group B was 90.6±3.81, which is found to be statistically significant (p<0.05) as depicted in Table 6.

Table 5: Distribution of patients according to percentage of graft take up.

Graft take up (%)	Group A		Group B		P
	N	%	N	%	
91-100	29	96.7	10	33.3	0.038
81-90	1	3.3	18	60.0	
71-80	-	-	-	-	
61-70	-	-	2	6.7	
51-60	-	-	-	-	
41-50	-	-	-	-	
31-40	-	-	-	-	
Total	30	100	30	100	
Mean ± SD	94.3±5.99		90.97±6.2		

Table 6: Comparison of granulation tissue fill-up percentage between groups.

Granulation fill-up (%)	Group A		Group B		P
	N	%	N	%	
≤80	0	0.0	2	6.7	0.026
81-90	7	23.3	8	26.7	
91-100	23	76.7	20	66.7	
Total	30	100	30	100	
Mean ± SD	93.23±5.03		90.6±3.81		

DISCUSSION

Nagaraj et al study assessing the feasibility and efficacy of topical negative pressure (TNP) dressing using a locally constructed TNP device and comparing it with regular gauze dressings for large wounds reported average duration of hospital stay was minimum of TNP dressing was 28.21 days and in conventional dressing was 37.28 days, they also reported average time taken for granulation tissue in TNP dressing 13.71 days and conventional dressing was 24.35 days.[16]

Priyatham et al prospective randomized comparative study assessing the efficacy of vacuum assisted closure as compared to conventional moist wound dressings in improving the healing process in chronic wounds reported shorter duration of hospital stay was observed in the vacuum dressing group, they also observed Increased rate of granulation tissue formation was seen in to vacuum dressing group when compared to conventional dressing group. Increased wound contracture was noted in vacuum dressing group compared to conventional dressing group, thus, better graft takes up was seen in vacuum dressing group as compared to the conventional dressing group.[17]

Koppad et al prospective randomized observational study evaluating the efficacy of topical negative pressure dressing with conventional moist wound dressings in healing of wounds reported mean duration of number of days of hospital stay in the study group is 42.36±13.78 and 46.76±28.36 in the control group, they also reported that percentage of granulation tissue formation in the

study group was 81.0±8.29 and in the control group was 53.60±19.23, which was found to be statistically significant (p value=0.00001), also reported that percentage of graft take up in the study group was 83.42±4.43 and in the control group was 63.18±11.24, which was statistically significant (p value=0.00001).[18]

Richhariya et al study evaluating the efficacy of NPWT compared with the saline moist gauze dressing reported time that elapsed between initial debridement and appearance of granulation, wound closure and total duration of hospital stay was significantly ($p<0.001$) shorter in the NPWT group than in the conventional dressing group.[19]

In the present study, the duration of hospital stay was minimum of 12 days and maximum of 48 days in group A and minimum of 22 days and maximum of 58 days in group B. The mean duration of hospital stay in group A and group B was 21.8±7.61 and 26.47±9.55 days respectively. There was significant difference between the groups as per student t-test ($p<0.05$), the mean percentage of granulation tissue formation in group A was 93.23±5.03 and in group B was 90.6±3.81, which is found to be statistically significant ($p<0.05$). This is in concordance to the studies of Nagaraj, Priyatham, Koppad and Richhariya et al.[16-19]

In our study the mean graft uptake of group A and group B was 94.3±5.99 and 90.97±6.2 respectively. There was significant difference between the groups as per student t-test ($p<0.05$). Priyatham and Koppad et al noticed similar observations in their studies.[17,18]

CONCLUSION

Our study concludes that negative pressure wound therapy is a useful choice for treatment of wounds when compared to treatment with conventional dressings therapy in terms of contraction of wound, time taken for wound healing and duration of hospital stay. The total number of debridement needed to be done were less in vacuum assisted closure dressings group, thus being more patient friendly and cost effective for the patient. The exudate from the wounds were better managed in case of vacuum assisted closure group, despite a smaller number of debridement as compared to conventional dressings group. In the vacuum assisted closure dressings group, the rate of granulation tissue formation, overall graft survival and patient compliance, were much higher, than in the traditional dressings group. However, it has been seen that the overall hospital stays and post-operative complications were less in the vacuum assisted closure dressing group. Topical negative pressure dressing is cost effective and therefore, overall hospital stay is less in the topical negative pressure therapy. Hence vacuum dressing is proved to be more efficient than the normal conventional dressings. Thus, in the management of contaminated wounds, vacuum assisted closure dressing may be considered as a superior choice.

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