MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.59218/makrjms.2023.11.211.214

OPEN ACCESS

Key Words
Negative pressure dressing, VAC therapy, modified VAC dressing

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Received: 21 November 2023
Accepted: 28 November 2023
Published: 30 November 2023

Citation: Sanjeev Patil, 2023. Comparison of Commercial Vacuum Dressing and Modified Vacuum Dressing in the Treatment of Non-Healing Ulcer. Res. J. Med. Sci., 17: 211-214, doi: 10.59218/makrjms.2023.11.211.214

Comparison of Commercial Vacuum Dressing and Modified Vacuum Dressing in the Treatment of Non-Healing Ulcer

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ABSTRACT
Vacuum assisted wound healing is a proven method of fast and better healing of wounds. With cellular, extracellular effects and bacterial clearance it leads to the rapid formation of healthy budding granulation tissue which provides wound bed for direct healing or secondary coverage for skin graft or flap. However, the vacuum assisted wound healing system is expensive, requires extensive amount of products. Hence, a modified vacuum dressing was brought to use to enable us to compare with the commercial vacuum dressing. In this study we compare the use of commercial vacuum dressing to modified vacuum dressing to evaluate the efficacy and cost of the procedure. The study was conducted in the Department of General Surgery in M R Medical College, Kalabu RAGI from January 2017 to July 2019 on 200 patients. Hundered patients each were divided into two groups by randomisation and were put into commercial vacuum dressing and modified vacuum dressing group. Patients were assessed for efficacy in terms of wound healing and cost of the dressing. Through our study it has been proven that modified VAC dressing and commercial VAC therapy was equal compared in percentage of granulation tissue and reduction in wound surface area. But the Modified VAC dressing therapy was more beneficial than commercial VAC dressing in cost effectiveness.

INTRODUCTION

The general category to which the trademarked VAC therapy is not a new concept in wound healing. The actual concept started in 1970s in Russia where they applied the principle of a vacuum chamber over the wound. In 1986, Kostiuchenok *et al*.[1] demonstrated the superiority of VAC dressing for infected wound after surgical debridement compared to surgical debridement alone. The VAC was first approved by Argenta and Morykwas in 1997.[1,2] The mechanism of this procedure is to reduce exudates and colonisation of bacteria, stimulate angiogenesis, increase perfusion and granulation tissue.[3-5] The VAC therapy system has its own disadvantage. It is expensive and requires extensive 2137 amounts of products and machinery, as well as functioning suction and a power source at all times. To overcome these problems the idea to a modification of VAC system with simple, accessible and cheap materials took place. This modification reached the same benefits as the commercial available VAC therapy. In our experience the cost has never exceeded 4USD for each dressing. Hence the present study was done to compare and evaluate the efficacy of modified and commercial vacuum assisted dressing in the management of wounds.

MATERIALS AND METHODS

A hospital based prospective observational study was done in the department of Surgery in M R Medical College, Kalabu RAGI from January 2019 to July 2021. A total number of patients admitted were 200. These 200 patients were divided into 2 groups, Group A Group B of 100 patients each by odd-even randomisation alternatively as per their presentation to the hospital in modified VAC dressing and commercial VAC dressing respectively.

Inclusion criteria: Patients with age between 18-70 years, all types of acute and chronic wounds in the lower extremities, wound size of 5 cm 2 and above and patients giving consent for vacuum therapy were taken into consideration.

Exclusion criteria: Patients with underlying osteomyelitis, fractures and malignancy in the wound were excluded from the study.

Methodology: Patients were thoroughly evaluated with relevant examinations and investigations. The wounds were debrided and wound dimensions and surface area was assessed. Before the start of the VAC therapy the wound was measured using double layer of polyethylene sheets which was held in place over the wound and the outline was traced using a marker pen. The layer in direct contact with the wound was discarded. The traced sheet was then put against the grid paper (2x2 mm) and its area was measured (Fig. 1). At the subsequent VAC dressing the wound was measured in the similar manner.

Data analysis: Data was compiled and analysed using SPSS software. T test was used to test the significant association between the two groups. $p<0.05$ was considered significant.

Materials used: The dressings in commercial VAC dressing (group B) done with commercial VAC therapy kit comprised of carbon activated sponge, portable motorised suction apparatus, sterile plastic cover (Fig. 2). The dressings in modified VAC dressing (group A) was done with autoclaved sponge, opsite, glove, sterile plastic cover, creating vacuum using wall suction unit and a ryles tube (Fig. 3). After initial thorough debridement of the wound the modified VAC dressing group wounds were placed with autoclaved sponge cut to make it correspond to the wound in size and depth and then a tunnel was created in it to allow the introduction of Ryles tube. The foam was then placed in the wound. After that we proceeded to application of sterile plastic cover/glove to cover the foam dressing. The edges were sealed using opsite in order to make it airtight. The end of the Ryles tube was then connected to the suction wall unit. The therapy was initiated by setting the vacuum gauge to a pressure of 125 mm Hg. The interruption of suction was done whenever needed for ambulation, wash and fulfilment of patient needs. In group B patients the wound was debrided and placed with activated carbon sponge cut to the wound size and covered with sterile plastic cover and connected to the commercial vacuum kit. In both the groups the dressing was changed after 5 days and a maximum of three dressings was done. It was then compared with the following parameters rate of granulation tissue formation, present dimension and surface area of the wound, cost of the therapy and wound surface area 2138 post therapy. All the patients in both the groups were then subjected to skin grafting, secondary suturing or flap cover (Fig. 4).

RESULTS

Two-hundred patients were observed in this study out of which 100 patients were included in the modified VAC dressing group (group A) and 100 patients were included in the commercial VAC dressing group (Group B). The mean age in modified VAC dressing was 47.86 and 46.61 in commercial VAC dressing. The mean of the wound surface area before the initiation of therapy was 54.51 cm 2 in modified VAC dressing and 57.55 cm 2 in commercial VAC dressing. In our study group the maximum size of the wound was 15 cm. The surface percentage change of granulation tissue fill up on day 5 was 29.19, day 10 was 19.51 and day 15 was 13.12. The surface

Table 1: Comparison groups

Age	No	Mean	Standard deviation	p-value
A	100	47.86	11.20	0.4389
B	100	46.61	11.59	
Wound surface area				
A	100	54.51	33.71	0.5217
B	100	57.55	33.26	
Percentage change of granulation tissue				
Day 5				
A	100	29.19	27.43	0.7870
B	100	28.16	26.40	
Day 10				
A	100	19.51	20.30	0.6916
B	100	18.4	19.20	
Day 15				
A	100	13.12	12.97	0.5956
B	100	14.1	13.10	
Wound surface area post therapy				
A	100	24.2	17	0.6281
B	100	25.3	15	
Cost				
A	100	2597.8	396	<0.0001
B	100	10755.6	2197	

percentage change of granulation tissue fill up on day 5 was 28.16, day 10 was 18.4 and day 15 was 14.1 in Group B. The wound surface area post therapy in group A was 24.2 and group B was 25.3. The mean cost of group A was 2597.8 and that of group B was 10755.6. There was no significant difference in surface area of the wound, percentage of granulation tissue formation among the two groups. Group A showed statistically significant difference in cost making it more economically beneficial for the patients as compared to commercial VAC dressing.

DISCUSSIONS

Wound healing is a complex process involving many cellular interactions, biochemical mediators, change in the micro environment and extracellular matrix resulting in structural and functional restoration of the wound[6]. Any disturbance in the factors will delay in healing of the wound. Negative pressure wound dressing boosts the physiological healing process for granulation tissue formation by reducing the number of dressing, the length of hospital stay and cost of the therapy[2,7,8]. It can be used in most of the wounds and contraindicated in malignant wounds, necrosis before debridement, osteomyelitis and underlying fractures. Negative pressure therapy decreases the oedema, increases the capillary blood flow and produces a traction force whereby decreasing the wound surface area and increasing the mitoticity in cells around the area9. Our study showed that the mean wound surface area was 54.51 in Group A and 57.55 in Group B before the start of the therapy. After the therapy the wound surface area reduced to 24.2 and 25.3 in Group A and Group B respectively. Which showed no difference in both the groups hence P value was not significant. The animal model study showed increased granulation tissue formation at 125 mm of Hg vacuum compared to low or high vacuum suction[10,11]. So we applied a pressure of 125mm of Hg vacuum. The KCI (Kinetic Concept, Inc) wound VAC system the NPWT kit the 3M VAC therapy kit and other commercial vendors provide negative pressure therapy for wounds that are expensive and may not be available everywhere. Hence a modified easily available VAC dressing was used and compared in this study. In our study we found no significant difference between the two groups in view of percentage of change of granulation tissue, wounds surface area post therapy which was noted by the P value being more than 0.05 (Table 1). Whereas there was a significant difference in the cost of therapy as P value was less than 0.05 (Table 1). Hence we found that Modified VAC dressing therapy to be useful in cost issues in developing countries and rural areas where availability of commercial device and cost of therapy is an issue.

CONCLUSION

Through our study it has been proven that modified VAC dressing and commercial VAC therapy was equal compared in percentage of granulation tissue and reduction in wound surface area. But the Modified VAC dressing therapy was more beneficial than commercial VAC dressing in cost effectiveness.

ACKNOWLEDGEMENT

Authors would thank everyone in their department and all the patients who participated in the study. We did not receive any funding source. The study was approved by the Institutional Ethics Committee. We declare no conflict of interest.

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