

Role of Vacuum-Assisted Closure in Wound Healing

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Abstract: Background Vacuum-assisted closure (VAC) is the new arsenal that could aid in managing acute and chronic wounds. Vacuum assisted closure also called negative pressure wound therapy is a procedure where one would use vacuum to enhance wound healing. **Objectives** To review the role of VAC in wound healing. **Methodology:** It was a prospective study among patients admitted to the department of ulcer with chronic non healing ulcer. The study period was between October 2012 to September 2021. 50 participants were enrolled into the study. The data collected were entered into Microsoft excel 2019 and the excel was then loaded into SPSS version 23 for further analysis. **Results:** The wound healing was found to be better from day 3 to day 7 and from day 7 to day 10. There was significant positive change in wound healing with P value of less than 0.05. The healing was not found to be associated with any other factor. **Conclusion:** Vacuum assisted closure would aid in wound healing among the patients with chronic non-healing ulcer.

Keywords: Chronic ulcer, non-healing ulcer, vacuum assisted closure, wound healing score, negative pressure, trauma, and diabetes mellitus.

1. Introduction

Vacuum-assisted closure (VAC) is the new arsenal that could aid in managing acute and chronic wounds. Vacuum assisted closure also called negative pressure wound therapy is a procedure where one would use vacuum to enhance wound healing. Vacuum-assisted wound closure refers to wound dressing that uses pressure below normal continuously or intermittently to the surface of a wound. The negative pressure is maintained by an apparatus. The above promotes healing in various kinds of wounds. It also helps in wound debridement. Wounds heal best when the negative pressure is 125 mmHg. Negative pressure removes fluid, decreases edema and increases blood flow. Thus, decreasing bacterial counts. The technique is less expensive than conventional management of complex wounds [1].

The technique is relatively simple. Sterile, porous foam dressing is directly placed on the wound. The wound is then closed with a sterile adhesive sheet in order to create a closed area. A tube is connected to a vacuum pump, fluid is sucked through the foam into a canister which is discarded. Negative pressure of 50-125 mm/Hg, results in the lowering of interstitial

pressure, and fluid and debris from the wound is sucked into a collection chamber. In the beginning, the vacuum is continuous. As the drainage decreases, the vacuum is applied intermittently. The vacuum dressing is usually changed at approximately two-day interval [2, 3, 4].

Wound progress is recorded using parameters in the wound scoring system⁵. The objectivity of assessments used to mark the wound score make this scoring system deal for evaluating treatment and outcome of wounds. And effectiveness of this treatment is established and proven by this objective scoring system. The present study was conducted with the objective of evaluating the role of Vacuum assisted closure in wound healing. No similar study was conducted in the institute with similar objective before. The study would pave way for a newer modality for treating wounds in the future.

2. Material and Methods

- **Study design:** Prospective hospital-based study
- **Study population:** Patients admitted to department of surgery, Rajah Muthiah Medical College and hospital, Annamalai University.
- **Study participants:** Chronic non-healing ulcer patients admitted to department of general surgery.
- **Study period:** October 2019 to September 2021
- **Study tool:** Pretested semi structured proforma.
- **Sample size:** 50 participants
- **Sampling technique:** Convenient sampling
- **Inclusion criteria:** Post traumatic cases of infected open, Wounds presented to hospital during the study period, Postoperative infected wounds, Non-healing wounds, Delayed healing wounds
- **Exclusion criteria:** Chronic osteomyelitis, Malignancy, Raw area with exposed vessels, nerves and tendons, Patients not willing for VAC therapy.

A. Procedure

1) Preparation of the wound

Dressings from the wound is removed. A swab culture is taken. Wound irrigated with normal saline. Surgical debridement is done and adequate homeostasis achieved.

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2) Foam placement

Foam dressings is cut to shape and kept into wound cavity. The wound is then sealed with an adhesive ensuring that the drapes cover the foam and tubing and at three centimeters of health skin.

3) Negative pressure application

Negative pressure is applied to the wound using vacuum pump, which delivers continuous or intermittent pressures, ranging from 50 to 125 mm Hg. The foam dressing squeezes to the negative pressure. The pressure is continuously for the first 48 hours and then changed. The outcome was measured using wound scoring system consisting of area of wound covered with granulation tissue and its colour and consistency.

4) Statistical analysis

The data collected were entered into Microsoft excel 2019 and the master chart was created. The master chart was then loaded into SPSS version 23 for statistical analysis. Both descriptive and inferential statistics were used for analysis. Both quantitative and qualitative data were available in the data collected. Percentages were used for describing the data. To compare the median between the groups, mann whitney U test and Kruskal wallis test were used. A P value of less than 0.05 was considered to be significant.



Fig. 1. Vacuum assisted closure done in the study

3. Results

36% participants were in the age group 41 to 50 years and 34% were in the age group 51 to 60 years. 76% of the participants were males and 24% of the participants were females. 60% participants were having the wounds between 10 to 30 days and 38% were having it for less than 10 days. 40% of the participants had wounds in the back and 32% had wounds in the leg. 54% of the participants were smokers. 50% were traumatic wounds followed by 36% were diabetic and 14% were vascular (Table 1) At day 3, 12% participants were having wound healing score of less than 3. The proportion decreased at day 7 to zero. Following VAC therapy. The progression in wound healing was found to be statistically significant (Table 2).

4. Discussion

Delay in wound healing contributes significantly to the community health problem especially in old adults, this requires

frequent visits to the hospital. With routine wound management, it takes days to months to heal the wound. Failure of the wound to heal creates a social and financial burden which cause pain and suffering. Vacuum-assisted closure (VAC) therapy is an alternative to the routine wound management, this uses negative pressure to optimize conditions and enhances wound healing and therefore few dressing changes⁶. Negative pressure therapy is an expensive, a recent report says that usage of VAC as a first-line therapy is not appropriate. However, we say that VAC can be made less expensive by using home brew techniques. Although clinical results are promising, there is a gap between scientific evidence which is available and usage in clinical practice does not give a balanced view³³. The use of negative pressure dressings, has been shown to be an effective way to accelerate healing of various types of wounds. The optimal pressure for wound healing appears to be minus 125 mm Hg. VAC is usually well tolerated and, has few contraindications or complications, will become a mainstay of wound care [7, 8].

The delayed healing in diabetes is associated with change in leukocyte infiltration and IL-6 levels in fluid from wounds during the late inflammatory stage of wound healing⁹. VAC dressings have certainly proven beneficial as a variant method of dressing, mainly by negative pressure therapy which sucks out serous fluid and help out in formation of granulation tissue. Used in various wounds, continuous suction for a period of 48 hrs and later intermittent suction depending on wound status have enhanced wound healing process and faster recovery compared to conventional methods of dressing. Diabetic wounds are always challenging; 18 cases managed by VAC therapy, 7 cases showed improvement in first 3 days of VAC therapy and of the other wounds later did not show improvement on prolonged therapy¹⁰. Two cases had to undergo amputation as a result of failure of VAC therapy and other conventional methods. The main problem cited with diabetic wounds was infection which flared up in few cases following closed VAC dressings. Hence diabetic wounds with infections did not benefit from VAC therapy; wound debridement with control of infection, later followed by VAC dressing would be more beneficial. Non-diabetic wounds; traumatic and vascular benefited from VAC therapy with faster healing in terms of granulation tissue formation. Infection was not a problem in spite of closed VAC dressing [11, 12].

Traumatic wounds also included cases of iatrogenic wounds. These showed better healing compared to other categories of wounds. There was a case of abdominal wall wound which showed good healing following VAC therapy. There were 7 cases of vascular wounds which included venous ulcers and ulcers associated with peripheral arterial disease. Venous ulcers showed better outcome when VAC was combined with other modalities of management like limb elevation. Maintaining negative pressure in VAC dressing and the contact of the foam to the wound surface were difficult. These two issues should be taken care of, for more effective usage of the VAC dressing. Other aspects to be considered are wound debridement and control of infection mainly in diabetic wounds, wherein we can delay VAC therapy until infection is controlled. In spite of the

data available, reduction in the bacterial count following VAC therapy practically was more difficult when dealing with diabetic wounds. Finally, even after considering the cost factor for VAC therapy, it is definitely a promising modality of dressing and proven beneficial in different varieties of wounds and enhances wound healing and faster recovery [13, 14, 15].

5. Conclusion

VAC therapy is a recent modality of treatment of wounds. Its introduction has changed the course of management of wounds. Based on the data from the present study and other studies available, VAC results in better wound healing, with very few complications, and promises to be a good modality in the management of various wounds. The usage of VAC is simple, but needs minimal training for competent use. Awareness about VAC and training on application of VAC dressings will make it more popular.

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