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Clinical Significance of Vacuum assisted Closure in Management of Infected Wound: An Observational, Comparative Study

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Learning Point of the Article:

Vaccum assisted closure (VAC) is more effective in treatment of chronic wound.

Abstract

Introduction: Vacuum-assisted closure (VAC) is an alternative method of wound management, which uses negative pressure to prepare the wound for spontaneous healing or for lesser reconstructive options.

Aims and Objectives: To determine the effectiveness of VAC dressings in the healing of chronic wounds, as compared to normal wound dressings.

Materials and Methods: The study was conducted among 60 patients with chronic wounds randomly divided into groups of 30 each, to compare VAC dressing with conventional dressings.

Results: There was a significant difference in total hospital stay, granulation tissue fill up and graft take up in both groups. The mean duration of hospital stay in Group A and Group B was 22.4 ± 5.61 and 28.57 ± 6.45 days, respectively. The mean percentage of granulation tissue formation in Group A was 94.12 ± 6.03, and in Group B was 91.2 ± 2.71

Conclusion: Activated Carbon dressing was found to be more beneficial and patient- 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 significantly contribute to morbidity and a reduced quality of life. They impact at least 1% of the population and pose a considerable risk for hospitalization, amputation, sepsis, and even mortality. Managing large wounds remains a major challenge for healthcare professionals, causing pain and discomfort for patients while also being financially burdensome [1-3].

Delayed wound healing, especially in complex wounds and elderly individuals with comorbidities, is a serious concern. It results in pain, prolonged treatment, increased morbidity, and often necessitates major reconstructive surgery, placing a substantial social and economic strain.

The complications associated with conventional dressing techniques for managing exposed wounds can be significant. In 1997, Morykwas and Argenta introduced vacuum-assisted closure (VAC) based on a porcine model study. Over the past two decades, extensive clinical and experimental research has

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Author's Photo Gallery

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Table 1: Age wise distribution of patients.			
Age group	Group A (n-30)	Group B (n-30)	Total
18–30	3	2	5
31–40	5	5	10
41–50	7	6	13
51–60	9	11	20
>60	6	6	12

evaluated this technology, demonstrating its effectiveness in treating both acute and chronic wounds. VAC therapy works by drawing wound edges together to reduce wound size, stimulating granulation tissue formation for skin grafting, enhancing microcirculation, reducing edema, and eliminating infectious tissues[4-7]

Although wound dressings have been used for over 2 millennia, no universally ideal dressing has been established. The selection of surgical dressings for both open and closed wounds is largely influenced by tradition, clinical training, and the surgeon's personal approach. Modern wound-healing strategies incorporate various types of moist dressings and topical agents; however, only a few have been proven to significantly enhance wound closure rates compared to traditional wet gauze dressings.

Over the past two decades, numerous innovative dressings have been introduced. Among them, negative pressure wound therapy has emerged as a promising technique that accelerates granulation tissue formation and promotes faster healing. This technology effectively reduces the time between debridement and definitive surgical closure in large wounds [8,9,10]

The present study was conducted to determine the effectiveness of VAC dressings in the healing of chronic wounds compared to normal wound dressings.

Chronic wound

A wound is considered to be chronic if it hasn't started to heal after 4–12 weeks despite treatment. These kinds of wounds usually arise as a result of poor blood circulation, diabetes or a weak immune system [11].

Table 3: Duration of hospital stay.				
Days	Group A (n-30)	Group B (n-30)	Total	P-value
>10	2	0	2	0.001
11–20	13	6	17	
21–30	10	12	22	
31–40	4	10	17	
41–50	0	1	1	
51–60	0	1	1	

Table 2: Sex wise distribution of patients.		
Sex	Group A	Group B
Male	25	26
Female	5	4

Materials and Methods

Study setting

A Hospital-based comparative, observational study was conducted in the department of Orthopedics of Dr. PDMMC hospital, Amravati.

Study population

All patients presenting with chronic wounds on upper or lower limbs were included in the study.

Study duration

The study was conducted for 12 months.

Sample size

The total number of patients admitted was 60.

Thirty cases received VAC dressing application, and the remaining 30 were managed with conventional dressings.

These 60 patients were divided into 2 groups, group A and group as per their presentation to the hospital in VAC dressings and conventional dressings, respectively.

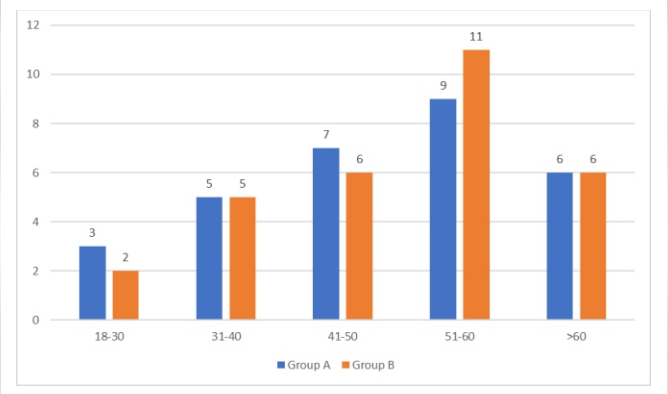
Inclusion criteria

- Patients aged between 18-75 years
- All types of chronic wounds, irrespective of etiology
- Wound site is limbs,
- Wound size of 5 cm2 and above that cannot be sutured,
- Patients giving consent for vacuum therapy.

Exclusion criteria

- Untreated underlying osteomyelitis
- Wounds that cannot be sutured for any reason
- Exposed vessels
- Wounds with unstable fractures or lose fragments of bone

Table 4: Duration of granulation tissue filling.				
Percentage	Group A (n-30)	Group B (n-30)	Total	P-value
60–80	0	3	3	0.003
81–90	6	8	14	
91–100	24	19	43	



Graph 1: Flowchart of the participants.

• Malignancy in the wound.

Methodology

Members of the study group were selected consecutively based on their presentation at the hospital, following the predefined inclusion and exclusion criteria. Patient history was obtained directly from each individual, and a case record form was completed for every participant. This form documented demographic details such as age, sex, and address, along with clinical information, including chief complaints, symptom duration, predisposing factors, and any prior treatments. In addition, medical history related to trauma, hypertension, tuberculosis, and other relevant conditions was recorded.

Patients, along with their relatives, nursing staff, and interns, were provided with detailed explanations about the procedure. They were also trained to monitor the treatment process and take appropriate action in case of any complications, such as a vacuum apparatus malfunction. Patients were divided into 2 groups for comparison purpose, Group A will receive VAC therapy and Group B will receive conventional dressings.

A double layer of polyethylene sheets was securely placed over the wound, and its outline was traced with a permanent marker. The layer directly in contact with the wound was removed, while the top layer was positioned against a 2 × 2 mm graphic grid to accurately measure the wound area to the nearest 4 mm^2.

During subsequent VAC dressing changes, the wound was photographed, and its area was remeasured using the same double polyethylene sheet technique. Before surgical intervention at the conclusion of VAC therapy, the wound's final appearance was documented.

Patients in both the test and control groups were monitored daily. The control group received conventional dressings, which were changed twice daily, whereas the test group underwent topical negative pressure dressings, which remained undisturbed for 2 days, with the wound being inspected twice daily.

Technique of application

The VAC dressing is a combination of a composite synthetic hydrocolloid sheet dressing and a vacuum-assisted wound closure system. The application technique consists of six key steps, followed for all patients in Group A:

1. Wound preparation: The wound was thoroughly debrided, and any devitalized tissue was removed.

2. Drain placement: A perforated drain tube was positioned on the wound bed, with its distal end brought out slightly away from the main wound.

3. Foam dressing application: Hydrocolloid foam dressing, pre-soaked in povidone-iodine solution, was cut to match the wound size and placed over the drain tube.

4. Sealing the wound: The foam dressing and surrounding healthy skin were covered with an adhesive, semi-permeable, transparent membrane, ensuring an airtight seal.

5. Applying negative pressure: The distal end of the drain tube was connected to a suction device providing a negative pressure of 125 mmHg, applied either continuously or intermittently (5 min "on," 2 min "off"). This was achieved using a wall suction apparatus, computerized devices, or mobile suction drain systems. Once the vacuum was applied, the foam collapsed into the wound bed, giving it a concave appearance while absorbing and removing wound exudate.

6. Monitoring and dressing change: Negative pressure was maintained for approximately 2 days for optimal benefit, as supported by studies. Once adequate granulation tissue had formed, the VAC dressing was removed, and definitive wound closure was performed using skin grafting.

At the end of 2 days, wounds in both groups were assessed after removing the dressings from the test group. The following parameters were evaluated:

• Rate of granulation tissue formation (percentage of the ulcer surface area)

After evaluation, both groups underwent split-thickness skin grafting. During the postoperative period, all patients received the same systemic antibiotics.

On the fifth postoperative day, wounds were reassessed based on:

• Duration of hospitalization.

After discharge, patients were followed up in the outpatient department after 1 month to assess post-skin grafting complications such as contractures, itching, pain, and infection. The results were statistically analyzed, focusing on:

• Rate of granulation tissue formation.

• Hospital stay duration.

The mean values for granulation tissue formation and hospital

stay duration were calculated and compared between both groups.

Table 1 shows that majority of the patients in our study were in the age group of 51–60, i.e., 20, followed by 13 in 41–50 years of age, 12 above 60 years, and least, i.e., 5 were 18–30 years of age (Graph 1).

Table 2 shows that majority were Males in both the groups, and females were 5 in Group A and 4 in Group B.

The mean duration of hospital stay in Group A and Group B was 22.4 ± 5.61 and 28.57 ± 6.45 days, respectively. There was a significant difference between the groups was seen as ($P < 0.05$) (Table 3).

The mean percentage of granulation tissue formation Group A was 94.12 ± 6.03 and in Group B was 91.2 ± 2.71, which is found to be statistically significant ($P < 0.05$) (Table 4).

Discussion

In our study, majority of the patients our study were in the age group of 51–60 years, i.e., 20, followed by 13 in 41–50 years of age, 12 above 60 years, and least, i.e., 5 were 18–30 years of age. The mean duration of hospital stay in Group A and Group B was 22.4 ± 5.61 and 28.57 ± 6.45 days, respectively. The mean percentage of granulation tissue formation in Group A was 94.12 ± 6.03, and in Group B was 91.2 ± 2.71.

Singh K et al conducted a study on 60 patients divided into 2 groups of 30 each to compare VAC dressing with conventional dressings.

Results

There was a significant difference in total hospital stay, number 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 [12].

Priyatham et al. prospective randomized comparative study assessing the efficacy of VAC 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 the conventional dressing group, thus, better graft takes up was seen in vacuum dressing group as compared to the conventional dressing group [13].

Yadav et al. found a significant difference in the duration of treatment among the three groups, with VAC being the least (Group 1, 31.17 days; Group 2, 24.13 days; Group 3, 15.17 days). The mean number of debridements was also significantly less in the VAC group (2.37, 2.43, and 1.60, respectively). The need for the secondary procedure, such as flap or skin graft, was also the least in the VAC group, although insignificant. The mean hospital stay of the study subjects was 31.17 days, 24.13 days, and 15.17 days in the 3 groups, respectively [14].

Conclusion

Our study concludes that negative pressure wound therapy is a useful choice for treatment of wounds when compared to treatment with conventional dressing therapy in terms of contraction of wound, time taken for wound healing and duration of hospital stay.

Clinical Message

Our result showed VAC is more effective in treatment in treatment of chronic wounds compared with standard moist wound care. We recommend VAC can be used widely in chronic wounds.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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