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Comparative study on the outcome of negative pressure wound therapy and conventional dressing in chronic non healing ulcer

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Abstract

Background: Wound therapy using Negative-pressure is a therapeutic technique, where vacuum dressing is used to promote wound healing in managing acute and chronic wounds. Fluid is continuously drawn out from the wound and as a result blood flow to the wound is increased, facilitating early wound healing. NPWT is cost effective, accessible, easy to administer, and may be compared with other conventional dressing especially in poor rural population.

The aim of this study was to establish the effectiveness of negative pressure therapy in management of non healing wounds.

Material and method: 60 patients admitted in surgical wards with non healing ulcers, were managed with Negative -pressure system over a period of six months from March 2018 to August 2018. Free end of closed type drain is connected to a specialised device to provide adequate negative pressure (150-250mmhg). In our study Intermittent negative pressure with 30 minutes negative pressure and 30 minutes rest cycle for 3 days followed by repeat saline dressing or skin grafting in the healthy wound to promote healing.

Results: Negative-pressure system accelerated wound healing, with development of healthy granulation tissue formation improved vascularity to the wound area. Most of the cases present to our institution with Healthy Non healing ulcer duration 12 days 21 cases (42%); least cases were present to us more than 24 days.

Conclusions: Negative-Pressure Wound Therapy found to a very effective affordable treatment for chronic non healing ulcers.

Keywords: Non healing ulcers, negative-pressure wound therapy, infection, wound healing, vacuum closure, sepsis

Introduction

Chronic non healing wounds are difficult to heal, in spite of regular wound management including antibiotic, debridement, and nursing care [1]. This may be due to co morbid conditions such as complications of an diabetes, immune compromised states, from surgery, trauma, or burns. Chronic wounds may lead to loss of earning of a bread winner, loss of limb, disabilities, or even death. The prevalence of chronic ulcers varies by condition and complications due to the condition that caused the ulcer [2]. There are, however, some data on condition-specific prevalence rates; for example, of patients with diabetes, 15% are thought to have foot ulcers at some time during their lives. Surgically created wounds can also become chronic, especially if they become infected and sometimes these wounds need to be open and let them heal on their own by secondary intention. Many types of interventions are being used in the treatment of non healing ulcers include surgical wound debridement where dead unhealthy granulation tissue is removed, chemical dressing, antibacterial dressing etc. In addition to treating underlying cause, improving general condition, correction of anemia, hypo proteinemia anti biotic to treat infection, contribute wound healing. Negative Pressure Wound Therapy (NPWT) is a noninvasive newer therapy that is used to manage chronic non healing ulcers using controlled negative pressure and Vacuum-Assisted Closure device (VAC) [3]. This NPWT helps to drain discharge from the wounds, promote healing through a sealed dressing connected to container by connecting tube. The pressure applied is sub atmospheric pressure dressing, found to be effective according to many literature reviews [4]. It is economical, affordable and promotes early wound healing connected to a collection container.

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Aims and objectives

1. To study the outcome of Negative Pressure wound therapy dressing in various wounds.
2. To evaluate the impact of Negative pressure wound therapy on granulation tissue formation.
3. To evaluate the impact of wound healing after Negative pressure wound therapy.

Inclusion criteria

Adult patients with chronic non healing ulcer of more than a month

Ulcer size 50cm² to 150cm²

Exclusion criteria

Pediatric patients

Septicemia

Osteomyelitis

Patients already undergoing other types of wound management

Methodology

Study conducted in Karpaga vinayaaga institute of medical science in Tamil Nadu. A total of 60 cases with chronic non healing ulcer between the period of May 2018-October 2019. Patients were divided in to two groups 30 each after informed consent. Ethical committee approval was obtained for this study. Group A was treated with (NPWT), Group B acted as control group with conventional dressing. Group A was treated with (NPWT), Group B acted as control group with conventional dressing. The observations were documented, and all results analyzed by using Student *t*-test for change in size of the wound, sugar level, age and sex from 7 th day to 56th day. The appearance of healthy granulation tissue and the primary study end point were analyzed for significance by using χ^2 test. Z-test was used for analysis of time status of the wound.

Inclusion criteria

- Only adult patients
- Ulcer area ranging between 50cm² and 250cm².

Exclusion criteria

- Septicemia.
- Osteomyelitis.
- Venous insufficiency

Vacuum assisted closures dressing applied under aseptic precaution for all the cases in Group using sponge with fenestrated closed type drain inserted diagonally to give uniform negative pressure over the ulcer site, wound covered with opsite sheet. Free end of closed type drain is connected to a specialised device to provide adequate negative pressure (-50 to -150mmhg). In our study Intermittent negative pressure with 30 minutes negative pressure and 30 minutes rest cycle for 3 days followed by repeat saline dressing or skin grafting in the healthy wound to promote healing. Control group received daily saline gauze dressings. Weekly cultures were taken from the ulcers to look for any bacterial growth. Antibiotics were given to all the patients as per the culture sensitivity report. Ulcers were treated until the wound closed until completion of the 56-days (8 weeks). (Spontaneously or SSG).

Results

Among 60 cases, 37 (74%) patients are associated with diabetes as aetiology, 13 (26%) patients had suffered with non-healing ulcer followed by trauma and 52 is mean age of the patient in

our study. After day 3 of NPWT 36 (72%) cases underwent skin grafting procedure. 14 (28%), cases wound healed without surgical procedure. 28(56%) cases were non-smokers, 22(44%) were smokers. Most common site for non healing ulcer in our study is Foot 16 cases (32%); least common site for Non healing ulcer in our study is Sole 7 cases (14%). Most of the cases present to our institution with Healthy Non healing ulcer duration 12 days 21 cases (42%); least cases were present to us more than 24 days.

Size of the wound showed no significant change in only I patient (1.67%). The mean decrease in the wound size in patients of -16.14 ± 13.04 cm² and that of Group B was -5.98 ± 14.41 cm². The observation was found to be statistically significant ($P < 0.05$). Wound closure was comparable in both the groups ($P > 0.10$), it was seen that the patients in Group A showed faster healing as compared to the patients of Group B. This was suggested by wounds of 9 (5+1+3) (60%) patients of Group A getting closed by the end of 4th week as compared to only 3 (0+2+1) (20%) patients of Group B. Although statistically the endpoint was comparable in both the groups ($P > 0.10$),) The healthy clean ulcer taken as a wound ready for skin grafting or healing by secondary intention spontaneously. Both the groups had received similar treatment for the closure of wound, the most common mode of wound closure being SSG. Failure rate was higher in patients of control group as compared to study group. Our study results consistent with findings of David Armstrong *et al.* who had observed that NPWT was safe and effective treatment for complex diabetic foot wounds.

Table 1

Variables	Wound Score @ day3		Total (n=50)
	Skin grafting not required (n=14)	Skin grafting required (n=36)	
Age in years			
• 21-30	1	2	3
• 31-40	3	6	9
• 41-50	2	9	11
• 51-60	2	11	13
• 61-70	4	8	12
• 71-80	1	-	1
• >80	1	-	1
Duration of wound			
• <12	8	13	21
• 12-24	3	16	19
• >24	2	8	10
Location			
• Foot	5	11	16
• Back	9	-	9
• Leg	2	6	8
• Ankle	3	7	10
• Sole	5	2	7
Smoking			
• No	16	12	28
• Yes	8	14	22
Etiology			
• Traumatic	7	6	13
• Diabetic	11	26	37

Representative Case



Fig 1: Pre VAC



Fig 2: Post VAC

Discussion

The role of negative pressure dressing in healing ulcers has been used as an innovative method of facilitating the chronic wound healing a way that it not only reduces bacterial growth and makes the ulcer dry, improves vascularity and mechanically applies the elasticity of surrounding healthy skin tissues [5]. It is well tolerated and relatively insignificant complications and few contraindications. Negative pressure wound therapy (NPWT) was devised in 1990's for healing the chronic ulcer. NPWT have

two variable delivering types, intermittent or continuous negative pressure through a specialized pump, which connected to a foam surface dressing to maintain a closed environment. The purpose of this study is to evaluate the outcome of this therapy for the management of chronic non healing ulcer.

The mean age of patients in study group was 61.23 ± 7.53 years and in control group was 55.30 ± 10.54 years which was comparable to the study done by Blume *et al.* A decreasing trend was observed in the presence of wound discharge in both the groups. However, it was noted that the rate of wound healing was faster in the study group as compared to the control. Only 13.23% of patients in study group had discharge at the end of 8th week as compared to 33.33% patients in control group. In a similar study conducted by Tamhankar *et al.* in mesh-related infection of post operative abdominal wounds found NPWT therapy allows salvage of infected exposed mesh by clearing the purulent discharge promoting granulation tissue formation.

We found a statistically significant difference in the percentage change in the wound size in both the groups ($P < 0.05$). The mean decrease in the wound size was more in the study group ($-16.14 \pm 13.04 \text{ cm}^2$) as compared to the control group ($-5.98 \pm 14.41 \text{ cm}^2$). Our study is consistent with McCallon *et al.* who had observed average decrease of 28.4% (± 24.3) in wound size in the VAC group as compared to 9.5% (± 16.9) average increase in wound size in control group. Robert Frykberg *et al.* also reported with NPWT the incidence of amputations also much less. Chronic wounds are implicated when delay in wound healing contributes significantly to the public health problem [7]. This causes frequent hospital visit, potential malignant transformation and a financial burden to the patients.

Various associated factors like diabetes mellitus delays wound healing well documented in many literatures [8]. In smokers wound healing also delayed because Nicotine causes vasoconstriction and promotes adhesiveness of platelets causing thrombus accumulation results in tissue ischemia because of these factors, wound healing is delayed causing agony for the patient results in repetitive dressing from weeks to months ultimately results in failure of the wound to heal causing pain, financial burden for the patient [9]. Vacuum Assisted closure (VAC) therapy is an active and effective alternative for wound management. The principle of negative pressure wound therapy (NPWT) to optimize conditions for the wound to heal, by enhancing and speeding up the healing process [10]. Commercially available VAC therapy is expensive but the use of customized techniques makes it less expensive, cost effective and fewer dressing change. In spite of clinical success of VAC into clinical practice, the effects of VAC on the wound are not clearly known. Many mechanisms have been suggested. VAC increases local blood flow and decreases Oedema fluid and colonization rates of microbes [11]. It promotes wound closure by speeding up the formation of granulation tissue and also by the mechanical effects on the wound, it provides a clean moist wound and clears excess wound fluid and creates an "ideal wound healing environment" [12]. Negative pressure wound management found to be more effective in reducing size of the ulcer, and bacteria free making it suitable for SSG. Vacuum-assisted closure therapy is a dynamic and non-invasive system for improving wound healing thereby reducing amputations rate in chronic non healing ulcers. This innovative therapy is based on applying air suction at a controlled sub-atmospheric pressure. The most important advantage of this therapy include, significant reduction in the wound area together with induction of new granulation tissue formation, effective wound clearance, and the continuous removal of exudates makes the wound dry.

The aim of this study was to describe our experience with VAC therapy for complex wounds

Conclusion

Negative pressure wound dressings facilitate fast healing than conventional dressing, in a short. NPWT is a cost-effective, technically simple to use and with better results. Prevention of complications and early wound closure make it an ideal choice in carefully chosen patients. Wound infections are considered as the main reasons for the increase in mortality and morbidity. It also increases the duration of hospital stay and increased incidence of amputations. Vacuum-assisted closure (VAC) therapy is a system that promotes wound healing through the application of negative pressure by controlled suction to the wound surface. Controlled negative pressure applied using VAC reduces duration of hospital stay and facilitates early wound healing. The application of controlled levels of negative pressure accelerates healing in many types of wound.

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