



Evaluation of Outcome of the Vacuum Assisted Closure in Patients with Infected Wound of Musculoskeletal System

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Abstract

Introduction: Infections to musculoskeletal system has always been a matter of great worry to the orthopedic surgeon. Wound healing remains a challenging clinical problem to orthopedic surgeon and correct, efficient wound management remains essential in total. To overcome this complication a novel innovation in wound therapy, Negative pressure wound therapy (NPWT), also known as vacuum assisted closure (VAC) dressing, which was described initially by the Fleishmann in 1993. And was introduced in clinical practice by Argenta and Morykwas, became an important and effective tool for successful treatment of infection in complex wounds. Negative pressure wound therapy (NPWT) has been associated with low complication rate and better patient compliance by providing greater comfort as well as reducing time of hospitalization, use of antibiotics, and number of dressing changes.

Aim: The aim of this study was to evaluate the results and benefits brought by the topical application of Vacuum-assisted Closure (VAC) in patients with infected wounds of musculoskeletal system.

Methods: This prospective study was conducted in a tertiary care hospital of north India from January 2017 to December 2018. The VAC therapy was used in 52 patients having infected wound of the musculoskeletal system with male to female ratio of 1.73:1. All these wounds failed to be closed primarily or required partial thickness skin grafting (PTSG) or flap coverage. The results were presented in suitable tabular and descriptive form. The negative pressure therapy (NPWT) was applied to the infected wound after proper Wound wash and debridement, in continuous mode for an average length of treatment of 20.63 days with a negative pressure between 75 to 200 mmHg.

Results: Intermittent negative pressure was applied in all patients. The frequency of VAC dressing change was done every 4-5 days .the average number of VAC dressing used were 4.3 .the mean use of negative pressure therapy was 20.63 days. The decrease in wound size attained by VAC therapy ranged from 2.8 to 26.3cm², with an average reduction of 12.13 cm². All the patients showed a positive outcome with respect to wound healing and complete eradication of infection.

Conclusion: VAC has been a reliable method of treating a variety of different wounds. The dramatic result of the VAC therapy by increases the rate of granulation tissue formation and by lowering of the bacterial counts to accelerate wound healing thus significant reduction in hospital stay and the readmission with the result the burden to the both hospital and to patient has been remarkable especially in developing country with decreased inpatient capacity. The fear of the pain and discomfort to patient due to regular dressing has made the application of VAC for patient a sigh of relief.

Introduction

Wound healing remains a challenging clinical problem to orthopedic surgeon and correct, efficient wound management remain essential in total^[1]. The infection to the extremities with loss of soft tissue which result in exposure of implant hardware and sensitive structures such as tendons, nerves, and bone has been one of the most challenging problem for the orthopedic surgeon^[2,3]. A number of surgical options have been described for this problem in the literature, which includes use of colloids, partial or full thickness skin grafting, rotation flaps and, flap transfers. All these surgical options are availed after serial debridement of devitalized tissue of the injured area to provide healthy tissue bed^[4]. However, this debridement is accompanied with both physical and psychological trauma due to repeated exposure to anesthetic agents severe pain during dressing changes^[5]. To overcome this complication a novel innovation in wound therapy, Negative pressure wound therapy (NPWT), also known as vacuum assisted closure (VAC) dressing, which was described initially by the Fleishmann in 1993^[6]. And was introduced in clinical practice by Argenta and Morykwas^[7], became an important and effective tool for successful treatment of infection in complex wounds. Negative pressure wound therapy (NPWT) has been associated with low complication rate and better patient compliance by providing greater comfort as well as reducing time of hospitalization, use of antibiotics, and number of dressing changes^[8,9,10]. Negative pressure wound therapy (NPWT) facilitates the healing by improving the rate of angiogenesis, endothelial proliferation, the integrity of the capillary membrane, capillary blood flow and by decreasing interstitial edema and bacterial burden within the wound^[11,12,13]

The aim of this study was to evaluate the results and benefits brought by the topical application of Vacuum-assisted Closure (VAC) in patients with infected wounds of musculoskeletal system.

Material and Method

This prospective study was conducted in a tertiary care hospital of north India from January 2017 to December 2018. The VAC therapy was used in 52 patients having infected wound of the musculoskeletal system. All these wounds failed to be closed primarily or required partial thickness skin grafting (PTSG) or flap coverage.

The above patients were selected by using following inclusion and exclusion criteria:

Inclusion Criteria

- Age <18 and >80 yrs.
- All lower limb wounds irrespective of cause and location.
- Wound infection presence confirmed by positive culture reports.
- Negative pressure therapy used for treatment in addition to the wound wash/debridement and I/V antibiotics.
- Negative pressure applied for at least 5 days.

Exclusion Criteria

- Non complaint patient whom removed the VAC dressing before completing 5 days post application.

Technique

VAC consists of Sterile polyurethane foam/sponge, suction pump, suction pipe, a reservoir, Sterile open – cell structured sponge which is cut to fit the size of wound adequately and is put inside the wound cavity. This sponge allows equal distribution of the negative pressure and also reduces the chances of high negative pressure, which can lead to tissue damage. An adhesive drape was then applied over the wound area with an additional 2-4cm border of healthy skin to provide an intact seal, which creates a vacuum by avoiding any contact with external environment. This adhesive seal is cut at only one place through which the tube is placed and this tube is connected with the vacuum generating and collecting unit on the other side. The dressing was applied after proper wound wash and debridement and Dressings were changed after every 4 to 5 days. At every dressing the presence or absence of

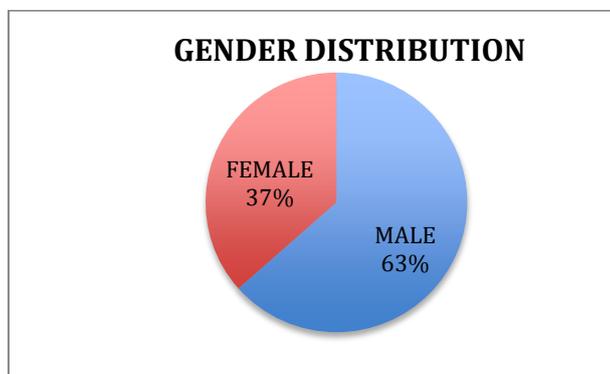
granulation tissue, erythema, infection, and amount of drainage were noted. Routine bacterial cultures and sensitivity testing were done at every dressing. Antimicrobial protocols were followed depending upon the culture and sensitivity report. The vacuum device was used until granulation tissue formed with little or no oedema or drainage,

Results

A total of 52 patients were included in the study who met the inclusion criteria, with a female to male ration of 1.73:1(table no. 1)

Table No. 1

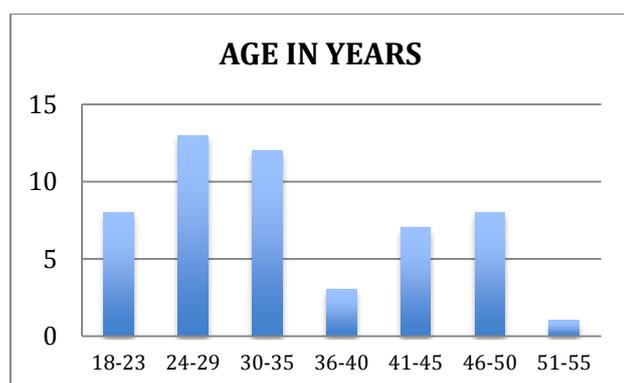
MALE	FEMALE
33	19



The average patient age was 33.5 years (range 18 to 63 years) (table no. 2)

Table No. 2

AGE IN YRS	NO. OF PATIENT
18-23	08
30-35	12
36-40	03
41-45	07
46-50	08
51-55	01
AVERAGE = 33.5yrs	



The most common cause of the infected musculoskeletal wound was diabetic ulcers (%) which was followed by Road traffic accident(%) and pressure ulcers (%) due to paraplegia. Lower limb, 34 (65.38%) were the commonly affected area followed by trunk 11 (21.15%) and upper extremity 7 (13.46%) (table no 3).

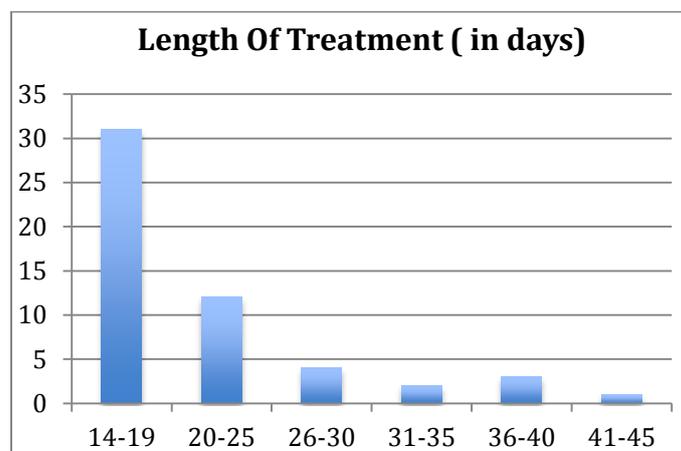
Table No. 3

Sr.no	Wound site	NO of patient
1	Upper extremity	07
	• Shoulder	02
	• Arm	00
	• Elbow	01
	• Forearm	01
	• Hand	03
2	Lower extremity	34
	• Thigh	04
	• Leg	17
	• Ankle	07
	• Foot	06
3	Trunk	11

The mean duration of the therapy was 20.63 days (range of 14–45 days) (table no 4).

Table No.4

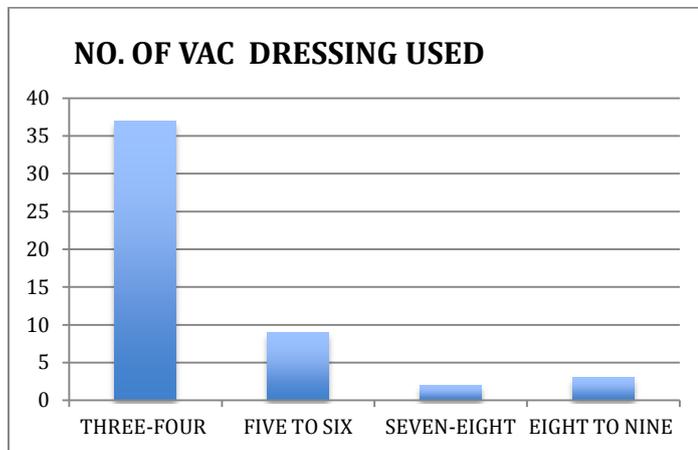
Length Of Treatment (days)	NO. OF PATIENT
14-19	31
20-25	12
26-30	4
31-35	2
36-40	3
41-45	1
AVERAGE LENGTH OF TREATMENT	20.63



Intermittent negative pressure was applied in all patients. The frequency of VAC dressing change was done every 4-5 days (table no 5).

Table No. 5

No. Of VAC Dressing Used	No Of Patients
03-04	37
50-06	09
07-08	02
09-10	03
AVERAGE VAC DESSING	4.3



The size of wound area at the time of initial presentation ranged from 6.32 to 108.67 cm², with the average area being 43.72 cm².

After the completion of VAC therapy, the wound area ranged from 4.13 to 91.46 cm², the average area being 29.42 cm².

There was decrease in wound size attained by VAC therapy ranged from 2.8 to 26.3 cm², with an average reduction of 12.13 cm².

Bacterial culture was taken from the wound at time of the initial debridement and before applying the VAC therapy. Repeat culture from the wound bed was taken at the end of the VAC therapy and sent to the microbiology laboratory. All patients achieved positive outcome with respect to wound healing, complete eradication of infection.

Among the 52 patient partial thickness skin grafting (PTSG) was done in 35 patients (67.31%), 9 patients required flaps to cover the wound and in 8 patients, the wound required no further intervention and healing was uneventful.

Discussion

The use of VAC therapy was an accepted as an excellent modality of management of wounds that are to be covered with skin grafts. VAC ideally

prepares the wound bed by decreasing wound edema and reducing the size of the wound^[14], thus facilitates the mobilization of the skin edges for delayed primary closure and in wounds that would require a local rotational or free flap. DeFranzo et al^[15] were able to successfully close 75 lower extremity wounds, 82 percent of which were traumatic or post-orthopedic procedure wounds, 95 percent of the wounds healed primarily; four required the additional removal of hardware or infected sequestrum before finally healing. our study showed promising results of the VAC therapy in consistent to the various other studies regarding final outcome of wound condition, Wounds in our study had an average surface area of 43.72 cm². This was approximately about 2 times larger than the average wound area of 20.7 cm² in the study by Armstrong and Lavery^[16] the reduction in wound size after VAC therapy was 27.74% which was in consistent to the study by McCallon et al., with an average decrease in wound surface area of 28.4% (SD 24.3) after VAC therapy^[17]. In our study, the length of time taken to complete VAC therapy ranged from 14 to 45 days, with an average of 20.63 days. This was shorter than the average time taken by Armstrong et al of 32.9 days^[18] and Clare et al of 57.4 days^[19]. In the study by Fleishman et al^[20] average number of VAC dressing change were 2.8 per wound which was comparable to our study with 4.3 average dressing change. In our study, wound culture was found to be positive for microorganisms for all patients at the start of VAC therapy. however, at the end of VAC therapy All wounds showed clearance of bacterial infection with repeat culture similar results were obtained in study of Morykwas et al^[21], with significant reduction in bacterial load of chronic wounds in animal model by the fifth day (n = 5), Compared to 11 days in control wounds which were untreated (n = 5). In developing country like India the affordability of the VAC therapy

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