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Original Research Paper

Outcome of Diabetic Foot Ulcer Management with Vacuum Assisted Closure

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ABSTRACT
Vacuum assisted dressing has been advocated as a novel method in the treatment of diabetic foot ulcer by stimulating the chronic wound environment Also known as Negative pressure wound therapy (npwt). A total of 100 cases clinically presenting with diabetic foot ulcer were included in the study. Fifty patients were enrolled in regular dressing group and the other 50 in VAC group. Outcome was measured using wound scoring system, duration of stay in hospital and categorizing outcome. In our clinical study after 8 days of admission 20% of patients who underwent VAC dressing had shown a high wound score compared to only 2% with normal dressing. Hospital stay and number of amputation were less with VAC dressing. Hence concluded that VAC therapy enhanced granulation tissue formation leading to better wound healing and faster recovery. Vac is thus a promising new technology in the field of wound healing.
Keywords - *VAC, negative pressure wound therapy, wound healing.*

INTRODUCTION

Vacuum assisted closure (vac) is a new technique in the challenging field of management of contaminated, acute and chronic wounds. Vacuum assisted closure (also called vacuum therapy, vacuum sealing or topical negative pressure therapy) is a sophisticated development of a standard surgical procedure, and involves the use of vacuum to remove blood or serous fluid from a wound or operation site[(1)]. Also known as Negative pressure wound therapy (npwt) and refers to wound dressing systems that continuously or intermittently apply sub atmospheric pressure to the surface of a wound. The application of controlled levels of negative pressure has been shown to accelerate debridement and promote healing in many different types of wound. The optimum level of negative pressure appears to be around 125 mm Hg below ambient and it is believed that negative pressure assists with removal of interstitial fluid, decreasing localized edema and increasing blood flow. This in turn decreases tissue bacterial levels. Despite the significant costs involved, the technique is said to compare favorably in financial terms with conventional treatments in the management of difficult wounds [(2,3)]

In essence, the technique is very simple. It involves application of sterile, open- pore foam dressing directly on the wound. The wound is then sealed with an occlusive drape in order to create a closed, controlled environment. A fenestrated vacuum tube is connected to a vacuum source, fluid is drawn from the wound through the foam into a reservoir for subsequent disposal. Negative pressure is applied at 55-125 mm Hg, resulting in a decrease in the local interstitial pressure, and effluent from the wound is drawn out into the collection device. Initially, the vacuum pressure is applied continuously. As the amount of drainage decreases, the vacuum may be subsequently being applied on an intermittent basis [(4)]. The vacuum dressing is usually changed at approx 4 days intervals.

MATERIALS AND METHODS

It's a Cohort study. A total of 100 cases clinically presenting with diabetic ulcer foot between may 2014 and December 2015 will be included in the study. fifty patients with ulcer foot will be enrolled in the regular dressing group, and 50 patients in the VAC group. 50 cases will be given regular dressing and debridement from the ward. In the next 50 cases a culture swab for microbiology will be taken after irrigation with normal saline. Surgical debridement will be done and after achieving adequate hemostasis, sterile sponge will be placed into the wound cavity. The site is then sealed with adhesive drape. Controlled pressure will be uniformly applied to all tissues on the inner surface of the wound using suction pump, which could deliver either continuous or intermittent pressures ranging from 50 to 125 mm hg. The pressure will be applied intermittently for 4 days and vac will be reapplied if indicated. The outcome will be measured using wound scoring system consisting of area of wound covered with granulation tissue, and its colour and consistency. Portion of wound gaining granulation will be marked as ¼, ½, 2/3 and complete wound area. Colour is represented as pale (unhealthy granulation), pink (moderately healthy) and bright red (healthy granulation). Consistency will be represented as spongy (unhealthy), solid(healthy). Recording will be done on day 4 and day 8. A comparison will be made on the healing rate with normal dressing and VAC dressing.

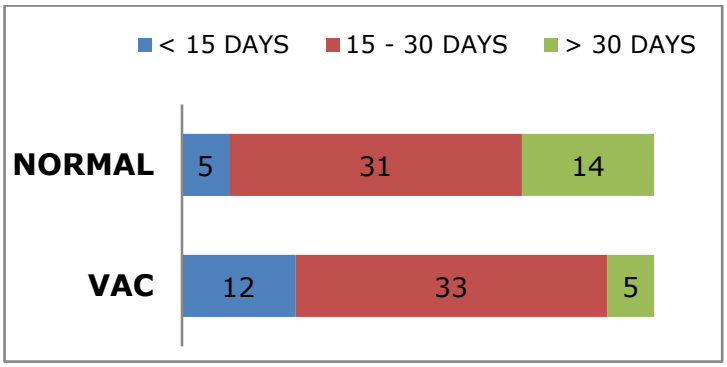
RESULTS

Wound score

Wound score DAY 8	Vac	Normal dressing
Less than 4	3	9
4-5	37	40
More than 5	10	1

After 8 days of admission 20 % of patients who underwent VAC dressing had shown a high wound score (>5), on the other side only 2% of patients with normal dressing had given high score. The P-value 0.005 for this is significant

DURATION IN HOSPITAL



24% of patients with VAC dressing were discharged before 15 days. While only 10% with normal dressing. 28% of patients with normal dressing had to stay in hospital for more than 1month, while only 10% with VAC dressing. P value – 0.027 is significant. Hence states that VAC dressing reduces the duration of stay in hospital. Mean hospital stay Case - 20.70 ± 7.089, Control - 23.02 ± 7.873

PRE AND POST VAC CULTURE & SENSITIVITY

		Vac dressing	*Normal dressing*
Culture result on day 8	Sterile	19	5
	Bacterial growth present	31	45

Most common organism cultured from the wounds during admission was staphylococcus aureus (36%). After 8 days of admission 38% of VAC dressed patients turned to be no growth, while its only 10% cases in normal dressing. The P value- 0.001 obtained is statistically significant.

PLAN AT END OF TREATMENT

	Normal dressing	Vac dressing
discharge	43	40
Ssg	1	7
amputation	5	3

Patient with VAC dressing have more split skin grafting (7) compared to normal dressing (1) before discharge. Compared to normal dressing less number of patients with VAC dressing had undergone amputation of any type.

DISCUSSION

Negative Pressure Wound Therapy (NPWT) has been advocated as a novel method in the healing of DFU by stimulating the chronic wound environment in such a way that it reduces bacterial burden and chronic interstitial wound fluid, increases vascularity and cytokine expression and to an extent mechanically exploiting the viscoelasticity of peri wound tissues (5). VAC is generally well tolerated and, with few contraindications or complications, is fast becoming a mainstay of current wound care. Hence, we planned to use NPWT for the treatment and fast healing of Diabetic Foot Ulcer. Our study composed of 100 patients who were randomly divided into two even groups.

The demographical profile was statistically studied and found comparable with no significant difference between the groups. The mean age of patients in study group was 54.72 ± 6.506 years and in control group was 57.70 ± 7.967 years which was comparable to the multicenter randomized controlled trial enrolling 342 patients done by Blume *et al*., [7] who had a mean age of 58 years. The sex distribution was also similar to the above quoted study that had 78% males.

Application of negative pressure over the wound bed allows the arterioles to dilate, increasing the effectiveness of local circulation, promoting angiogenesis, which assists in the proliferation of granulation tissue [(6)]. We observed that the patients on VAC therapy had the early appearance of granulation tissue as compared to the patients treated by moist saline gauze dressings. Complete (100%) granulation was achieved earlier and in a higher proportion of patients in Group A as compared to Group B. Similar observations were made in a series of animal studies using a sub-atmospheric pressure technique for wound healing [(6)]. Armstrong and Lavery observed that the use of negative pressure therapy resulted in an increased rate of granulation tissue formation and a higher proportion of healed wounds compared to saline gauze dressings [(5)].

Colonization of a wound has been recognized as a detrimental factor in the process of wound healing. In our study most common organism culture from the wound are staphylococcus aureus (36%), then pseudomonas aeroginosa (19%). VAC therapy enhances bacterial clearance, which may account for the wound healing effects. In our study After 8 days of admission 38% of vac dressed patients turned to be sterile, while its only 10% cases with conventional dressing. It gives a p value of 0.001, which is significant. Morykwas et al. studies showed a decrease in the bacterial load in wounds treated with negative pressure therapy, [(8)] Mouës et al. studies showed there is a decrease in non fermentive Gram-negative bacilli and S. aureus increased [(9)]

In our study, following VAC therapy wound scoring was done with scores from 0-7 given for area of granulation tissue color and consistency of granulation tissue. The wounds with scores > 5 following VAC therapy can be considered for skin graft. After 8 days of admission 20 % of patients who underwent VAC dressing had shown a high wound score (>5), on the other side only 2% of patients with normal dressing had given high score. The p value of this is 0.005 and is significant. Mark et al. had also observed that the wound volume and depth decreased significantly in VAC dressings as compared to moist gauze dressings [(11)]. We observed the safety of VAC over saline-moistened gauze dressings, in terms of fewer numbers of secondary amputations in Group A as compared to Group B. While assessing the safety of VAC, Blume et al. also reported fewer number of secondary amputations in VAC treated patients as compared to those treated by gauze dressings [(7)].

Both of the groups received similar treatment for the closure of the wound, the most common mode of wound closure being a split-thickness skin graft. In 14% of patients, wounds were closed by a split-thickness skin graft in Group A as compared to only 2% of patients in Group B during the stay in hospital.. Our observations are consistent with those of Prabhdeep et al. who also reported a split-thickness skin graft as the most common mode of wound closure [(12)].

In Group A patients, overall lower doses of insulin were required to control hyperglycemia compared to Group B. Success rate in terms of complete granulation and readiness for closure by split-thickness skin grafting or secondary intention was more in Group A compared to Group B.

We observed that numbers of patients undergoing amputations are less with vac dressing compared to the normal dressing. Armstrong et al. observed that NPWT delivered by VAC device was safe and effective treatment for complex diabetic foot wounds and could lead to a higher proportion of healed wounds, faster healing rates and potentially fewer re-amputations than standard care [(5)].

Patient satisfaction in terms of time taken for wound closure, number of antibiotics used, treatment related complications and outcome was better in Group A compared to Group B and overall resource utilization was more in Group B. Apelqvist J et al. also found a beneficial effect in terms of direct economic cost and resource utilization in patients treated with VAC compared to standard moist wound therapy [(13)].

CONCLUSION

In conclusion, NPWT appears to be more effective, safe and patient-satisfactory compared to conventional dressings in the treatment of foot ulcers in people with DM. V A C dressing does appear to result in better healing and faster granulation tissue formation. V.A.C dressing decreases Hospital stay. V.A.C dressing improves pus culture sensitivity. V.A.C dressing improves outcome.

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