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"COMPARITIVE STUDY OF THE ROLE OF VAC DRESSING AND CONVENTIONAL DRESSING IN MANAGEMENT OF DIABETIC WOUNDS"

General Surgery

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ABSTRACT

Background: Diabetic foot ulcers (DFUs) are a serious complication of diabetes mellitus, leading to increased morbidity, risk of limb amputation, and substantial healthcare costs. Managing these wounds effectively remains a challenge, necessitating innovative treatment modalities like Vacuum-Assisted Closure (VAC) therapy, which promotes wound healing through negative pressure. **Aim & Objectives:** This study aimed to compare the effectiveness of VAC therapy versus conventional saline dressings in managing diabetic wounds. The objectives included assessing wound healing time, extent of wound size reduction, and overall wound management outcomes. **Material And Methods:** A prospective, hospital-based study was conducted over 18 months, enrolling 60 patients with chronic diabetic ulcers larger than 1 cm. Patients were randomly assigned into two groups: one treated with VAC therapy, and the other with conventional saline dressings. Wound parameters such as size, depth, and healing progress were measured every three weeks. All patients received appropriate antibiotics, and cultures guided antimicrobial therapy. **Results:** The study included 60 patients equally divided into VAC and conventional dressing groups, with similar age and gender distributions. Bacterial culture profiles revealed no significant differences between groups, and blood parameters (hemoglobin, fasting blood sugar, HbA1C) showed no notable variance. Wound size at baseline was comparable (mean: VAC 53.97 mm² vs. conventional 56.02 mm²). Over three months, the VAC group exhibited markedly superior wound healing: the mean final wound area was significantly reduced to 35.2 mm² compared to 48.92 mm² in the conventional group ($p<0.001$). The average reduction in wound area was 18.44 mm² for VAC versus 7.08 mm² for conventional dressings. Percentage of area reduction was also higher with VAC (33.8% vs. 12.89%, $p<0.001$). Furthermore, the duration of wound contracture was shorter in the VAC group, averaging 4.47 weeks compared to 6.14 weeks in the conventional group ($p<0.001$). These findings demonstrate that VAC therapy significantly accelerates wound healing, promotes faster tissue contraction, and reduces total healing time. **Conclusion:** VAC therapy significantly enhances wound healing outcomes in diabetic ulcers by accelerating contraction and reducing overall healing time. Its integration into standard wound care can improve patient prognosis and limb salvage rates, making it a valuable adjunct in diabetic wound management.

KEYWORDS

Diabetic foot ulcers, Vacuum-Assisted Closure (VAC), Wound healing, Chronic wounds, Wound contraction, Diabetic wound management.

INTRODUCTION:

Approximately-500 million people currently have diabetes mellitus (DM), and this number is predicted to increase significantly over the next several years. [1] As the prevalence of the disease increases, so do the complications, which affect almost all of the body's systems. Along with other serious aftereffects, diabetic wounds are a major cause of morbidity and mortality among the overall effects of diabetes. [2,3]

An ulcerated foot associated with peripheral vascular disease and/or neuropathy in a diabetic is known as a diabetic foot ulcer (DFU). Peripheral neuropathy, peripheral vascular disease, immunosuppression, and the decline of glycemic control are commonly cited causes. [4] Diabetic wounds cause 50% to 70% of lower limb amputations and hospitalization for about 50% of diabetic patients. Relative mortality after diabetic wounds is estimated to be 48% after five years. [2,3]

An important factor in the pathophysiology of diabetic wounds is the interaction between sensorimotor neuropathy and arterio-occlusive disease. [5] Diabetic wounds are a complex form of osteomyelitis or cellulitis brought on by the interaction of invasive bacteria and the host immune system. [6] Diabetic wounds must be promptly identified and presented to the hospital for prompt treatment in order to significantly reduce associated morbidity and mortality. A multidisciplinary team approach is required for the management of diabetic wound disease, which can reduce the frequency of total amputations in at-risk diabetic patients by 49–85%. [7]

The mainstay of diabetic wound care is dressing, with debridement and antibiotics added as needed. Currently, three common therapeutic approaches include foam dressing, standard dressing, and negative-pressure wound therapy/vacuum-assisted closure (VAC). [8] Originally presented by Argenta and Morykwas in 1997, —vacuum- assisted closure is a non-pharmacological, non-surgical technique for improving wound healing. With its several operating modes and ability to provide constant and continuous negative pressures, vacuum-assisted closure (VAC) therapy is a cutting-edge type of negative pressure drainage technology. It is necessary to maintain the appropriate negative pressure range of 125 mmHg to 200 mmHg. [9] VAC is essential for promoting angiogenesis, increasing blood circulation, controlling infection, accelerating wound closure, and promoting the growth of granulation tissue in wounds. Because of its proposed multiple benefits, topical negative pressure (TNP) therapy is widely used to treat acute wounds in vascular patients. Effective medical therapy is essential for diabetic foot with ischemic causes, but revascularization - either open vascular surgery or endovascular techniques - is critical to preventing limb loss. VAC promotes blood circulation, angiogenesis, granulation tissue development, and infection prevention. A higher rate of limb preservation is made possible by VAC therapy when combined with debridement and appropriate bacterial treatment. [10,11]

The effectiveness of VAC dressing versus traditional dressing in the therapy of diabetic wounds must be thoroughly compared, given the substantial burden that diabetic wounds place on patients and healthcare systems. With an emphasis on their effects on wound healing, infection management, and general patient well-being, this study attempts to assess the clinical results of these two therapy modalities. In order to help clinicians choose the best dressing technique for diabetic wounds, a thorough investigation will offer evidence-based insights.

AIM & OBJECTIVES:

1. To study the aetiology and clinical features of diabetic wounds.
2. To analyse the role of VAC dressing and conventional dressing in management of diabetic wounds.
3. To compare the healing process of diabetic wounds treated with VAC dressing and conventional dressing.

MATERIAL AND METHODS:

This prospective, hospital-based study was conducted at

Muzaffarnagar Medical College to compare the effectiveness of Vacuum-Assisted Closure (VAC) dressing versus conventional saline dressings in managing diabetic wounds. Over an 18-month period, 60 patients with chronic diabetic ulcers larger than 1 cm were enrolled after screening based on specific inclusion and exclusion criteria to ensure suitable candidates. Patients were randomly assigned into two groups: one received standard saline dressings, and the other was treated with VAC therapy, which involved wound preparation, surgical debridement, foam placement, and application of negative pressure at optimized settings. Wound size and depth were measured every three weeks over three months to monitor healing progress. All patients received appropriate antibiotics, and wound cultures informed treatment modifications as needed. Ethical approval and informed consent were secured, with confidentiality maintained throughout the study. Data were analyzed statistically, with variables like healing time, wound size reduction, and regression assessed to compare the two approaches. The study aimed to identify whether VAC therapy facilitates faster healing and better wound management in diabetic patients, providing insights for improved treatment protocols.

RESULTS:

The socio-demographic profile of participants in the present study showed that the groups—those who received VAC dressing and those who received conventional dressing—were quite similar regarding age and gender. The age distribution included participants across various decades, with the majority falling within the 40-49 and 50-59 age groups. Statistical analysis indicated no significant difference between the groups in terms of age, as reflected by the p-value of 0.655. Similarly, the gender distribution was evenly matched, with 70% male and 30% female in both groups, and there was no significant difference in gender composition, evidenced by a p-value of 1.000. Overall, these findings suggested that the two groups were socio-demographically comparable, which helped ensure that any observed differences in treatment outcomes were less likely to be influenced by these variables. **(Table 1)**

Figure 1 shows that 66.7% of patients in the conventional dressing group and 53.3% of patients in the VAC dressing group in our study showed no growth of cultures (NOGC). Other bacterial isolates, like Pseudomonas aeruginosa (PA) and Staphylococcus aureus (SA), were marginally more prevalent in the VAC group than in the traditional group. The wound culture profiles showed no statistically significant difference, suggesting that the groups' bacterial loads were comparable ($p>0.05$).

Table 2 compares the levels of haemoglobin, fasting blood sugar, and HbA1C between participants receiving VAC dressing and those with conventional dressing. The mean haemoglobin levels were slightly lower in the VAC group (11.11) compared to the conventional group (11.62), but this difference was not statistically significant ($p = 0.079$). Similarly, fasting blood sugar levels were marginally lower in the conventional group (115.73) than in the VAC group (110.73), with no significant difference ($p = 0.078$). For HbA1C, the mean was slightly higher in the VAC group (7.86) compared to the conventional group (7.65), but again, this difference was not statistically significant ($p = 0.298$). Overall, the analysis indicated that there were no significant differences in these blood parameters between the two dressing groups.

Table 3 compares wound healing outcomes between the VAC dressing and conventional dressing groups. Initially, both groups had similar wound areas, with mean measurements of about 54 mm^2 for VAC and 56 mm^2 for the conventional group, showing no significant difference ($p = 0.359$). By the final assessment, wounds in the VAC group had significantly reduced more, with an average area of 35.2 mm^2 compared to 48.92 mm^2 in the conventional group ($p < 0.001$). The change in wound area also favoured VAC, with a much greater mean reduction of 18.44 mm^2 versus 7.08 mm^2 in the conventional group, a difference that was highly significant ($p < 0.001$). Additionally, the percentage of area reduction was significantly higher in the VAC group at 33.8%, compared to just 12.89% with conventional dressing ($p < 0.001$). These results suggest that VAC dressing was more effective in promoting wound size reduction and healing compared to conventional dressing.

The comparison of wound contracture duration showed that wounds in the VAC dressing group contracted faster, with a mean duration of 4.47 weeks, compared to 6.14 weeks in the conventional dressing group. This difference was statistically highly significant ($p < 0.001$), indicating that VAC dressing was more effective in reducing the time needed for wound contracture and healing. **(Table 4)**

Table 1: Socio-demographic Profile Of Participants:

Variables	VAC dressing (n=30)	Conventional Dressing (n=30)
Age group (Years)		
30-39	6(20.0)	5(16.7)
40-49	11(36.7)	10(33.3)
50-59	6(20.0)	11(36.7)
60-69	5(16.7)	3(10.0)
70-79	2(6.7)	1(3.3)
χ^2=2.442, df=4, p value=0.655		
Gender		
Female	9(30)	9(30)
Male	21(70)	21(70)
χ^2=0.000, df=1, p value=1.000		

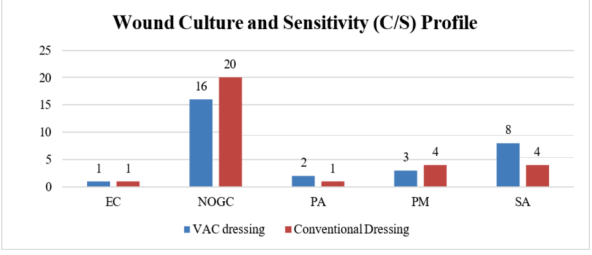

Figure 1: Wound Culture and Sensitivity (C/S) Profile

Table 2- Comparison Of Hemoglobin, Fasting Blood Sugar, And HbA1C Levels Between VAC Dressing And Conventional Dressing Groups

Variable	VAC dressing		Conventional Dressing		Test of significance	
	Mean	SD	Mean	SD	t value	p value
Haemoglobin	11.11	0.86	11.62	1.3	1.79	0.079
Fasting Blood Sugar	110.73	11.07	115.73	10.5	1.795	0.078
HbA1C	7.86	0.83	7.65	0.69	1.051	0.298

Table 3- Comparison Of Wound Area (Initial, Final, And Change In Area) Between VAC Dressing And Conventional Dressing Groups

Variable	VAC Dressing		Conventional Dressing		Test of significance	
	Mean	SD	Mean	SD	t value	p value
Initial area (mm^2)	53.97	8.8	56.02	8.32	0.925	0.359
Final area (mm^2)	35.2	6.78	48.92	7.98	7.177	<0.001
Change in Area (mm^2)	18.44	3.68	7.08	0.85	16.469	<0.001
% of Area Reduction	33.8	3.89	12.89	1.89	26.452	<0.001

Table 4- Comparison Of Duration Of Wound Contracture (In Weeks) Between VAC Dressing And Conventional Dressing Groups

Variable	VAC Dressing		Conventional Dressing		Test of significance	
	Mean	SD	Mean	SD	t value	p value
Duration of Wound Contracture (weeks)	4.47	0.39	6.14	0.45	15.515	<0.001

DISCUSSION:

The 40–49 age group had the largest percentage of patients (35%) in the current study, followed by the 50–59 age group (28.33%). 18.33% of patients were in the 30- to 39-year-old age range, however the percentage gradually decreased as patients aged, reaching 13.33% in the 60- to 69-year-old range and just 5% in the 70- to 79-year-old range. There was no statistically significant difference in the two groups' mean ages, which were 48.97 ± 11.39 years for the VAC group and 49.77 ± 9.68 years for the traditional dressing group. Our findings were consistent with those of **Ahmed S. et al**., who studied 40 patients to find the average healing time for vacuum- assisted wound closure in patients with diabetic foot ulcers. With a mean age of 50.00 ± 9.75 years and the majority of patients (45%) being between 41 and 50 years old, they noted a similar age distribution. [12] In their study, **Anjum et al**. found that the mean ages of the VAC group and the usual dressing group were similar, at 42.95 ± 9.29 and 46.30 ± 9.33 years,

respectively.[13]

The sex distribution of our patients was the same in the VAC and conventional clothing groups, with 70% of them being men and 30% being women. This result is comparable to that of **Ahmed S et al.**, who found that the majority of their patients were men (62.5%). This inequality may also be caused by the ways that men and women seek healthcare differently. [12]

60% in our study had no bacterial growth on wound culture. Staphylococcus aureus (SA) was the most commonly isolated pathogen among patients with positive culture results (20%). Pseudomonas aeruginosa (PA) was found in 5% of cases, Enterococcus (EC) in 3.33%, and Proteus mirabilis (PM) in 11.67% of cases. No growth of cultures (NOGC) was seen in 66.7% of patients in the traditional dressing group and 53.3% of patients in the VAC dressing group. Other bacterial isolates, like Pseudomonas aeruginosa (PA) and Staphylococcus aureus (SA), were marginally more prevalent in the VAC group than in the traditional group. Our results were consistent with research by **Ali Z et al**. that compared VAC therapy with traditional dressings for the treatment of lower limb ulcers that do not heal. According to their findings, the most prevalent bacteria in culture was Pseudomonas aeruginosa, which was found in 13 (43.3%) of the patients. Staphylococcus aureus was found in 10 (33%), Escherichia coli in 4 (13%), and Acinetobacter baumannii in 3 (10%) of the patients. On the other hand, Staphylococcus aureus was found in 14 patients (46%), Pseudomonas aeruginosa in 12 patients (40%), and mixed flora in 4 patients (13.3%) from the wounds in the standard dressing group.[14]

In our study, mean haemoglobin levels were slightly lower in the VAC group (11.11 ± 0.86 g/dL) than in the conventional group (11.62 ± 1.3 g/dL), but the difference was not significant (p=0.079). Mean fasting blood sugar (110.73 ± 11.07 vs. 115.73 ± 10.5 mg/dL, p=0.078) and HbA1C levels (7.86 ± 0.83 vs. 7.65 ± 0.69, p=0.298) were also comparable. **Ali Z et al** documented similar haemoglobin levels in their study, reporting a mean of 10.4 g/dL in the VAC group and 11.2 g/dL in the conventional dressing group, supporting our findings.[14]

There was a statistically significant difference in the end wound area between the VAC dressing group and the conventional group. VAC therapy was more successful than traditional dressings at promoting wound healing, as seen by the VAC group's much larger mean reduction in wound area. Similar findings were reported by **Ahmed S et al**, who showed that after VAC therapy, the original average wound area of 50.6±27.6 cm² decreased to an average size of 11.4±4.55 cm². [12] According to **Singh R et al.**, the size of the wound after VAC therapy was considerably lower than it was after conventional dressing, and the patients who used VAC dressing experienced a noticeably larger reduction in wound size than those who used conventional dressing. [15] Additionally, **Sakthi Abirami R et al** observed a noteworthy distinction in the reduction of wound size between diabetic patients treated with VAC dressing and those treated with conventional dressing, concluding that VAC dressing was better to conventional dressing in this regard.[16] According to **Putnis et al.,** NPWT lowers the length of hospital stays and the incidence of complications.[17]

The VAC dressing group in the current study had a much higher percentage of wound area decrease than the traditional dressing group. There was a difference between the two study groups that was statistically significant. According to **Ali Z et al.**, patients treated with VAC dressing in our trial showed similar efficacy in reducing wound size, with an average reduction of 56%, while the group treated with traditional dressings showed an average reduction of 29%. [14]

According to the current study, the VAC dressing group experienced wound contracture for an average of 4.47±0.39 weeks, while the traditional dressing group experienced it for 6.14±0.45 weeks. This notable discrepancy implies that VAC dressings caused wounds to heal more quickly than traditional dressings. This result is in line with several research. According to **Ahmed S. et al.**[34], patients in the VAC group had an average recovery duration of 21.75±10.55 days. [12] In addition, **James SMD et al.** shown that the VAC therapy group's duration for complete wound healing was noticeably longer than that of the normal dressing group. [18] **Singh R et al.** demonstrated that the VAC therapy group's duration for complete wound healing was much longer than that of the standard dressing group. The VAC therapy group's overall wound closure time was 41.2 days, while the conventional group's was 58.9 days.[15]

CONCLUSION:

In the present study, vacuum-assisted closure (VAC) therapy demonstrated superior efficacy over conventional saline dressings in managing diabetic wounds. Patients treated with VAC experienced significantly faster wound contraction, greater reduction in wound size, and a shorter duration of wound contracture. There were no significant differences in baseline infection profiles, hemoglobin levels, or glycemic control between the two groups, indicating that the observed improvements were attributable to the dressing modality itself. VAC therapy's ability to promote angiogenesis, enhance blood circulation, and facilitate faster wound healing underscores its potential as a preferred treatment option for diabetic ulcers. Incorporating VAC into standard wound management protocols can significantly improve healing outcomes, reduce hospitalization time, and potentially lower the risk of limb amputation. These results support the wider adoption of VAC therapy as an effective adjunct in diabetic wound care.

Limitations Of The Study:

This study's limitations include its relatively small sample size and single-center design, which may limit the generalizability of the findings. The short follow-up duration of three months may not capture long-term healing outcomes or recurrence rates. Additionally, variability in wound etiology and patient comorbidities could influence healing, and these factors were not extensively controlled. Further multicenter studies with larger populations and longer follow-up periods are needed to confirm these results and assess the cost-effectiveness and practicality of widespread VAC therapy use in diabetic wound management.

Relevance Of The Study:

This study is highly relevant given the growing prevalence of diabetes mellitus and its associated complications, particularly diabetic foot ulcers, which significantly impact patient morbidity, mortality, and healthcare costs. Demonstrating the superior efficacy of VAC therapy offers a valuable, evidence-based approach to enhance wound healing, reduce healing time, and potentially prevent limb amputations. Its findings support integrating advanced wound management techniques like VAC into standard care practices, aiming to improve clinical outcomes, optimize resource utilization, and improve quality of life for diabetic patients with chronic wounds.

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