

**Evaluation of the Outcome between Dressing and Vacuum-Assisted Closure for Chronic Non-Healing Ulcers**Anand Pandey<sup>1</sup>, Ravi Parmar<sup>2</sup><sup>1</sup>Assistant Professor, Dept. of Surgery, Autonomous State Medical College, Gonda, U.P.<sup>2</sup>Assistant Professor, Dept. of Surgery, People's Medical College and Research Centre, Bhopal (M.P)

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Corresponding Author: Dr. Ravi Parmar

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**Abstract:**

**Introduction:** Social and economic issues arise from chronic wounds after three months. Foot ulcers impact 25% of people with diabetes. There are problems with traditional saline dressings. Hydrocolloid alternatives lack scientific support. VAC promotes blood flow and tissue preservation by using FDA-approved foam and adjustable sub-atmospheric pressure. A successful technique for wound treatment is the VAC procedure, which uses scheduled vacuum cycles.

**Aim and Objectives:** A comparison study of chronic non-healing ulcers should be performed to determine the effectiveness of dressings vs. vacuum-assisted closure in wound management.

**Method:** The Shree Krishna Hospital research of 50 chronic non-healing diabetic foot ulcers from January 2022 to December 2023 includes a pre-formed questionnaire. The study included male and female patients of all ages and sexes. One group received standard dressings, while the other group received vacuum-assisted closure. Concerning the treatment, both groups were appraised. Cost, patient convenience, results, SINBAD score, and therapy duration are evaluated.

**Result:** There is a significant gender imbalance in the study, with 68% men out of 50 participants. Conditions such as ulcer duration, family history, hypertension, hypothyroidism, and ischemic heart disease vary. Vacuum-assisted closure (VAC) reduced wound size more consistently and significantly (-4.84) than standard dressings (-3.6). Comorbidities were associated with a larger health metric improvement (-4.2) than non-comorbidities (-3.2).

**Conclusion:** Chronic foot ulcers cause diabetes hospitalizations. A 2004 50-case experiment shows that Vacuum-Assisted Closure (VAC) therapy is successful, satisfying, and cheaper than standard dressings. Comorbidities impact dressing gently, not V.A.C. healing.

**Keywords:** Hydrocolloid, Vacuum-Assisted Closure (V.A.C.), diabetes mellitus.

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**Introduction**

Wounds which have not seen a prompt, organised healing process that has restored their functionality and structural integrity within three months are commonly referred to as chronic wounds. According to Leaper and Durani, it is a wound that fails to heal completely after six weeks or does not see a 20–40% reduction in size between two and four weeks after the finest treatment. The inflammatory condition of these ulcers lasts for an extended duration and does not undergo healing. These ulcers significantly affect both the social and economic standing of the sufferer and their family [1]

Non-healing ulcers can arise as a result of issues stemming from an underlying condition, such as diabetes mellitus, or as a consequence of surgical procedures, physical injuries, burns, or prolonged pressure. These are predominantly prevalent in the geriatric population with chronic ailments, particularly diabetes, and the foot is the organ most usually impacted. A study indicates that up to 25%

of those diagnosed with diabetes mellitus may experience the formation of foot ulcers at some point during their lifetime [2]

The recommended method has always been saline-moistened gauze, yet it has proven challenging to use these dressings regularly to maintain a moist environment. Later on, several Other wound remedies that have been suggested include hydrocolloid wound liquids, growth hormones, enzymatic debridement substances, hyperbaric oxygen therapy, and cultured skin replacements. Each of these treatments incurs substantial costs and is employed in certain cases without adequate scientific proof supporting their effectiveness[1,2].

Diverse products and strategies have been employed to expedite the healing process. The concept of utilising negative pressure on a wound within an enclosed setting was formulated by several organisations, including Chariker & Jeter, who detailed a technique based on gauze. Fleischmann et

al., a German team, documented the treatment of individuals using foam dressings applied to open fractures. Morykwas and Argenta published the first such study in 1997, including the use of the open-cell foam dressing combined with a controlled vacuum to treat acute and long-term wounds [3]. Vacuum dressing, the same therapeutic approach is also referred to as vacuum sealing/vacuum pack treatment, subatmospheric pressure treatment, and topical negative pressure therapy. The mechanism of vacuum therapy involves a complex interaction of elements, including eliminating germs and toxins, regulating moisture levels, improving blood flow and vascularity, and promoting wound granulation. This ultimately leads to the facilitation of wound healing. Additionally, evidence supports the use of vacuum dressing in enhancing blood flow to the skin, reducing fluid buildup between cells (edema reduction), and playing a crucial role in preserving damaged tissue. Vacuum-assisted closure (VAC) entails applying open cell foam to an appropriate wound, securing it with a sticky drape, and treating the wound with sub-atmospheric pressure regulated [4,5].

The dressing used by VAC consists of open-cell polyether foam made of medical-grade polyurethane and has been approved by the FDA for use on open wounds. The pore size typically ranges from 400 to 600  $\mu\text{m}$ , considered optimum for tissue growth. The foam is precisely tailored and tightly adhered to the specified injuries. It has an embedded drainage tube with side openings attached to the reticulated foam. Reticulation ensures the adverse pressure is applied uniformly across the wound bed. After that, a sticky curtain is put over the designated location, extending a further 3–5 cm past the skin that is still intact to form a full seal [5,6]

The evacuation tube is attached to a canister that holds wastewater and an adjustable vacuum pump. The timing (continuous vs. intermittent) and strength that produce the vacuum effect may be adjusted for the pump. Typically, a periodic pattern (5 minutes of activity followed by 2 minutes of rest) is utilised as it has been proven to be the most advantageous [6].

## Method

### Research Design

A cross-sectional observational prospective, hospital-based study involving a pre-formed questionnaire about the duration of diabetes, duration of diabetic foot ulcer and progression, associated family history, and any comorbidities if present was done. The research was conducted on 50 chronic non-healing diabetic foot ulcers from January 2022 to December 2023. The study was conducted in the Department of Surgery, Shree Krishna Hospital of Pramukhswami Medical College, Karamsad. Patients presenting to the

outpatient department as well as in-patients having chronic non-healing diabetic foot ulcers, irrespective of age and sex were considered for the study. The study included all documented instances of diabetic ulcers, regardless of gender and age, who presented to the outpatient department (OPD) or were admitted to the hospital. The patients were randomly separated into two groups, one receiving dressing and the other receiving vacuum-assisted closure, with 25 patients in each group. They were then provided with detailed information regarding many aspects of the treatment modality, including the estimated duration of therapy, cost-effectiveness, potential outcomes, and the advantages and disadvantages of each modality. The first group comprises patients treated using traditional dressings, excluding vacuum-assisted closure. The second group consists of patients who were treated using vacuum-assisted closure. The results obtained from employing multiple modalities will be evaluated based on numerous criteria, such as the overall duration and cost of therapy, patient convenience, outcomes of the different modalities, and the SINBAD score.

### Inclusion Criteria

- All known cases of chronic non-healing diabetic foot ulcers irrespective of sex and age present to OPD.
- The patients who were admitted and on regular medication for diabetes will be inclusion criteria.

### Exclusion Criteria

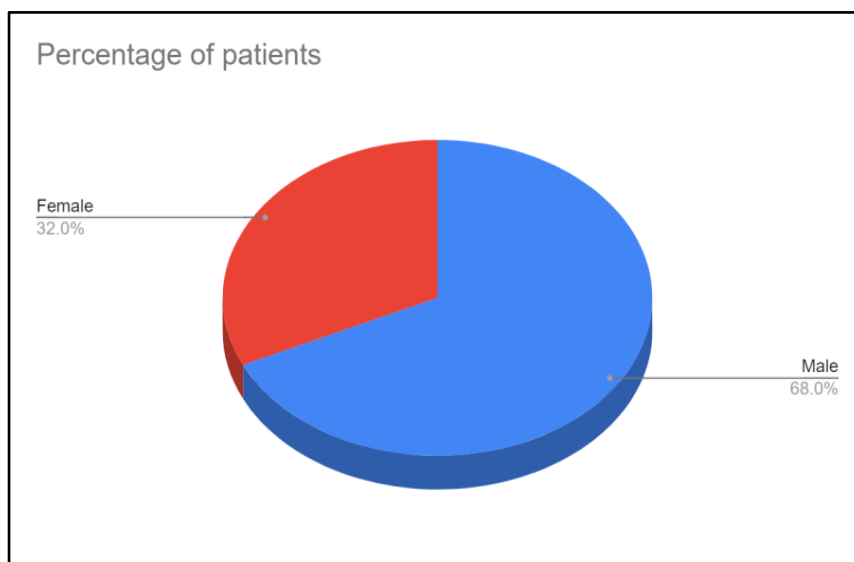
- Wound less than 2cm.
- The patient was diagnosed as a case of diabetes but not on regular treatment.
- Freshly diagnosed case of diabetes.

### Statistical Analysis

Manual analysis was carried out by sorting out all the questionnaires collected. Data were entered into the computer by the principal investigator followed by data cleaning. Descriptive analysis and correlation study models were used to study all the variables.

### Results

Figure 1 shows the gender distribution of study participants, including Male and Female frequencies and percentages. The study involved 50 people: 34 (68%) men and 16 (32%) women. This representation summarises the gender distribution of the research population, showing that men comprised the vast majority of the sample. The study's findings may be less generalisable due to the increased male presence. The gender imbalance may affect health outcomes, hence gender-related aspects and differences must be considered when evaluating the study's conclusions.



**Figure 1: The distribution of the study participants based on gender**

Table 1 shows the research participants' ulcer length, family history, HTN, hypothyroidism, and IHD history. Regarding the duration of ulcers, the largest proportion of participants (34%) reported a period of 6 months, while 28% reported a duration of 8 months. Regarding familial background, 36% of the subjects had no familial history of ulcers, whereas 18% had a confirmed positive familial history. The incidence of hypertension was relatively high, with

56% of subjects reporting its presence. The prevalence of hypothyroidism in the population was 22%, while 28% of persons reported having ischemic heart disease. These data offer a brief overview of how several health variables are distributed among the study participants. They also indicate probable factors that could be linked to the occurrence and length of ulcers in the population being studied.

**Table 1: Patient history**

Ulcer duration(months)	Frequency	Percent
6	17	34
7	8	16
8	14	28
9	9	18
10	2	4
Family history	Frequency	Percent
Yes	32	18
No	64	36
History of HTN	Frequency	Percent
Present	28	56
Absent	22	44
History of Hypothyroidism	Frequency	Percent
Present	11	22
Absent	39	78
History of IHD	Frequency	Percent
Present	14	28
Absent	36	72

Table 2 shows wound care modality, patient count, mean, and SD. The table presents a comparison between two methods, dressing and Vacuum-Assisted Closure (VAC), in terms of their influence on the process of wound healing. Regarding the dressing modality, 25 patients experienced an average decrease in wound size of -3.6, showing a reduction in wound size. The standard deviation of 0.957 suggests some variation in the individual responses. In

contrast, the VAC modality demonstrated a significant average reduction of -4.84 in wound size among 25 patients, with a smaller standard deviation of 0.374, indicating a more consistent and reliable impact. The data indicate that the VAC modality will likely have a stronger and more consistent effect on reducing wound size than the dressing modality in the patients investigated.

**Table 2: Comparison between two methods, dressing and Vacuum-Assisted Closure**

Modality	No. of patients	Mean	S.D
Dressing	25	-3.6	0.957
VAC	25	-4.84	0.374

Table 3 shows the association between comorbidities, patient numbers, and mean and standard deviation for a health condition. Comorbidity is dichotomous, with 15 patients having them and 10 without. The mean change in some health metrics (not specifically indicated) for patients with comorbidities is -4.2, indicating a greater improvement or reduction,

compared to -3.2 for those without. The standard deviation for the comorbidity group is 0.788, showing some response variability; for the non-comorbidity group, it is 0.861. These findings suggest a link between comorbidities and a greater improvement in the health metric, but individual responses deserve additional study.

**Table 3: The relationship between the presence of comorbidities**

Comorbidities	No. of patients	Mean	S.D
Present	15	-4.2	0.788
Absent	10	-3.2	0.861

Table 4 shows how comorbidities, patient numbers, and mean and standard deviation affect health parameters. Comorbidity is dichotomous, with 20 patients and 5 without. Comorbid patients' mean health parameter change is -4.8, indicating a significant improvement or reduction. Those without comorbidities have a mean change of -5.0, indicating an even greater improvement. The standard deviation for the group without comorbidities is 0.000, indicating no

response variability. Both groups showed a significant and consistent improvement in the health parameter, with individuals without comorbidities displaying a little larger mean change and no variability in their answers, suggesting a more uniform response to the intervention. For a complete understanding, the health parameters and intervention must be considered.

**Table 4: The relationship between the presence of comorbidities**

Comorbidities	No. of patients	Mean	S.D
Present	20	-4.8	0.410
Absent	5	-5.0	0.000

## Discussion

Therapy using vacuum-assisted closure (VAC) has demonstrated efficacy in treating a wide range of wounds. Nevertheless, there is a scarcity of information about the efficacy of this treatment especially about diabetic foot ulcers (DFUs) and the Indian populace. VAC treatment, or vacuum-assisted closure, significantly lowers the duration required for wound healing, accelerates the production of granulation tissue, and diminishes the size of the ulcer region in contrast to conventional dressing techniques. The VAC treatment group did not have a statistically significant increase in bleeding or infection rates, according to the research [7]

Non-healing ulcers pose a significant health challenge on a global scale and have a profound impact on the individual's personal, career, and social life. Additionally, they impose a significant strain on both the patient and the medical system. Non-healing, resistant ulcers are a significant factor in Amputations of lower limbs due to non-traumatic

causes. Regular dressings are necessary for wound healing and can be done using the standard approach or Vacuum Assisted Closure (VAC). An investigation was carried out to assess the effectiveness of individually tailored VAC therapy compared to standard dressings for treating ulcers that do not heal. Regarding non-healing wounds, vacuum-assisted closure offers a good substitute for conventional dressings. It is economical and encourages improved wound healing, providing advantages over traditional dressings [8].

Chronic, open, nonhealing wounds are an ongoing difficulty in medicine. Our study's objective was to determine if vacuum-assisted closure (VAC)\* treatment is more effective than traditional saline-wet-to-moist (WM) dressings at speeding up the healing process of chronic wounds. Thirty-six individuals with persistent, nonhealing wounds were included in the research. Following proper permission, these patients were added to the experiment. Random assignment was used to place participants in the VAC and control groups. The independent wound that is blinded evaluators

collected biopsies and measured wounds. VAC experienced a substantial depth change of 66 per cent, but WM only had a 20 percent depth change. Granulation tissue production was observed in 64 percent of the lesions in the VAC group, which was the main characteristic. The utilisation of the VAC system is recommended for achieving wound closure, particularly for chronic nonhealing wounds that are very deep, as opposed to the conventional saline wet-to-moist dressings [9]

A comparative study evaluated the effectiveness of normal dressings against vacuum-assisted closure (VAC) for treating diabetes-related foot ulcerations (DFUs). The study evaluated the healing rate (time required for wound closure through natural healing or surgical intervention), safety, and patient satisfaction as the primary outcome measures. Vacuum-assisted closure (VAC) demonstrates superior efficacy, safety, and patient satisfaction as compared to traditional dressings in the management of diabetic foot ulcers (DFUs) [10]

To evaluate and compare the efficacy of foam dressing, traditional dressing, & vacuum-assisted closure (VAC) for the treatment of diabetic foot ulcers (DFUs), a prospective randomised experiment was conducted. The best option among the several dressing options is VAC dressing. methods due to its ability to promote rapid healing and reduce the length of hospitalisation. Foam dressing is a cost-effective alternative that yields superior outcomes compared to traditional dressing methods [11]

While vacuum-assisted closure (VAC) is widely used in several surgical specialities, its application in the foot and ankle field has not been proven. This research aimed to determine if vacuum-assisted closure treatment (VAC) is effective in speeding up the healing process for wounds caused by peripheral vascular disease and diabetic foot ulcers, its effectiveness in debriding wounds, and its potential to reduce the necessity for additional surgical interventions. Vacuum-assisted closure (VAC) therapy is a useful adjunct to standard care for chronic wounds or ulcers in patients with peripheral vascular disease or diabetes. The utilisation of this technique in foot and ankle surgery results in expedited wound closure and, for the majority of patients, eliminates the necessity for additional surgical procedures [12]

Negative pressure wound therapy (NPWT) is a commonly employed approach for wound management. We conducted a comprehensive analysis of randomised controlled trials (RCTs) that compared the advantages and disadvantages of Utilizing conventional wound care (SWT) in conjunction with negative pressure wound treatment (NPWT) for patients whose wounds are healing owing to intention. In conclusion, using negative

pressure wound treatment (NPWT) appears to provide a more significant advantage than conventional wound treatment (SWT) in encouraging the closure of wounds that are healing without surgical intervention, based on the available low-quality evidence. The duration of hospitalisation is also reduced. The statistics indicate that NPWT does not provide any benefits or drawbacks for other outcomes that are meaningful to patients. A major problem in NPWT investigations is publication bias, highlighting the need for thorough reporting across all clinical trials [13].

## Conclusion

This study concluded that chronic non-healing Diabetic foot ulcers are the most common reason for hospitalisation of diabetic patients. VAC is well-tolerated and becoming a cornerstone of wound care due to its limited contraindications and problems. A Tucson, Arizona team of experts introduced V.A.C. therapy guidelines for diabetic foot treatment in 2004. Since 2004, V.A.C. therapy has gained clinical support with a big Lancet RCT in November 2005, several small RCTs, retrospective investigations, and significant case series. Clinicians should use evidence-based medicine to select the best treatment for patients. This consensus document is based on level 1 and level 2 evidence, supporting the recommendations of the multidisciplinary expert panel. While correct debridement, infection management, and blood flow are necessary for limb salvage or foot reconstruction, the V.A.C treatment System has helped clinicians handle complicated wound problems with simpler remedies. Pre- and post-treatment SINBAD scores were evaluated in 50 cases (25 each), and V.A.C. was found to be better for chronic non-healing diabetic foot ulcers. V.A.C. had higher patient satisfaction and economic effectiveness than conventional dressing. In this trial, comorbid conditions impacted dressing healing but did not significantly delay V.A.C. healing.

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