

A comparative Study of standard dressing verses vac therapy dressing in diabetic foot ulcer patients

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Abstract

A severe and debilitating sign of untreated diabetes that manifests as ulcers on the foot is diabetic foot ulcer. About 20% of hospital admissions for diabetes mellitus among patients are believed to be related to it. The severity of problems including amputation and mortality can be decreased by treating ulcerations effectively and early on. The aim of this study was to assess and compare the effectiveness of vacuum-assisted closure dressings to standard dressings in terms of healing rate, granulation tissue formation, treatment duration, and patient satisfaction. Thirty patients participated in the six-month trial, which was conducted at A.C.S. Medical College and Hospital. They were divided into equal-sized groups. Patients in groups 1 and 2 (n = 15 each) got vacuum-assisted closure dressings and standard dressings, respectively. By comparing size and grade of the ulcer before and after treatment show signs of healing and the formation of granulation tissues. After treatment, the size and grade of ulcers varied significantly, with vacuum- assisted closure dressing having high amount of variation (mean size: 2.47, grade of ulcer :0.13, P value: 0.001) compared to standard dressing (mean size:4.13 grade of ulcer:1.13). Within a month or two, 93.3% of patients completed their treatment, and no longer were dissatisfied with vacuum- assisted closure dressing. As a result, the study concluded that vacuum- assisted closure dressing is more beneficial and effective than standard dressing.

Keywords: Diabetic foot ulcer; Vacuum- assisted closure dressing; Standard dressing; Diabetic management.

1. Introduction

A diabetic foot ulcer (DFU) is characterized by a disruption of the epidermis and a portion of the dermis in a diabetic patient. Pre-ulcerative lesions are more closed or superficial and do not pierce the dermis (e.g., callous, blister, warmth, or erythema); yet, they have a significant chance of developing into ulcers [1]. The lifetime risk to a person with diabetes for developing a foot ulcer could be as high as 25% [2]. Diabetes-related foot ulcers are caused by peripheral neuropathy (sensory, motor, and autonomic), trauma, infections, ischemic illnesses, and neuro-ischemic conditions[3]. The most widely used classification of DFU is Wagner's classification. Several classification systems are currently in use to evaluate and determine the severity of diabetic foot. These systems attempt to encompass different characteristics of an ulcer (namely site, depth, the presence of neuropathy, infection, and ischemia, etc.). These systems include the Wagner System, University of Texas System and a hybrid System, Depth Ischemic classification, the PEDIS System [4,5]. The proper clinical assessment of foot examination may be helpful in treating ulceration according to their illness. Both a physical examination and an appropriate history gathering are part of a thorough foot examination.

Dermatological, musculoskeletal, neurological, vascular, and foot and ulcer examinations are all included in the physical examination[6]. Early and efficient diabetic foot ulcer (DFU) care might lessen the severity of consequences like mortality and avoidable amputation. Studies have shown that the management of DFU should include blood sugar control, advanced dressing, preventive care, invasive modalities such skin grafting and debridement and non-invasive

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approaches like hyperbaric oxygen therapy and negative pressure wound dressing. Vacuum-assisted closure (VAC) therapy is a new generation of negative pressure drainage technology that offers multiple mode of operation and the ability to provide steady, and continues negative pressures. The optimum level of negative pressure should be maintained around 125 mmHg to 200 mmHg [7,8,9,10,11]. Interstitial fluid removal, decreased localized edema, increased blood flow, granulation tissue development, decreased bacterial colonization, moist wound healing environment, and enhanced epithelial migration are all promoted by NPWT. The aim and objective of this study were to compare the effectiveness of healing rate, formation of granulation tissue, duration of treatment, and patient satisfaction in VAC dressing versus standard dressing for diabetic foot ulcer patients.

2. Material and methods

The comparative analysis was carried out at A.C.S. Medical College and Hospital for the sixth month. The study included thirty people in total, chosen based on the following inclusion criteria. They were split into two groups, A and B, each with fifteen members, at random. Every patient who took part in the trial gave their written informed consent. Patients had the option to withdraw from the study at any time, and their data was kept private.

- *Inclusion criteria:* Patients more than 18 to 70 years of age of both male and female, with diabetic foot ulcer attending as outpatients in Surgical OP and those admitted in the surgical wards with ulcer are classified into different grading based on WAGNER'S classification of DFU were included in the study.
- *Exclusion criteria:* Patient's ulcer with underlying osteomyelitis, severe malnutrition, wound occurred due to burns; diseases with a poor prognosis (including malignant tumors), Serology positive patients, pregnant women, nursing mother were excluded from the study.
- *Clinical assessment:* Complete blood counts, blood glucose levels, liver and kidney profiles, and inflammatory markers were among the general blood tests carried out. At the time of admission, the condition of the wound was noted, including its depth, size, grade, and presence of gangrene or slough. As standard procedure, a wound swab for culture sensitivity was delivered to every patient. Antibiotics were given intravenously when needed, and their dosages were adjusted based on the findings of sensitivity and culture tests. Depending on the state of the wound, all patients had the initial surgical debridement at the operating room or by the patient's bedside. Each patient's glycemic control was maintained appropriately.

2.1. Method of Dressing

We separated the samples into two groups, A and B. In group A, fifteen patients were chosen at random for VAC therapy. The wounds were treated with hydrogen peroxide, given a saline wash, and, if necessary, debridement was performed. A 16Fr Ryle's tube was positioned in between two layers of sterile open pore form to apply VAC. A sterile transparent synthetic hydrocolloid sheet was then used to close the wound. The suction device was linked to the tube, and the pressure was adjusted to -125 mmHg. During the procedure, the suction apparatus is in for 20 minutes and out for another 20 minutes. The VAC therapy setup is removed according to patient's ulcer condition and the amount of granulation tissue formed is noted. Both the ulcer's size before and after dressing are recorded. In group B, randomly 15 patients were selected for standard dressing, cleaning is done with hydrogen peroxide and normal saline and dressing the wound with povidone iodine (5%), dry sterile gauze and pad is used for dressing and it is necessary to wash wound and change dressing for every day. The size of ulcer is noted before and after dressing.

2.2. Statistical Analysis

Analysis of data was done using Statistical Package for the Social Science version 22 (SPSS Inc., Chicago, IL, USA). Quantitative variables were described in the form of mean and standard deviation. Qualitative variables were described as number and percent. In order to compare parametric quantitative variables between two groups, paired t test was performed. Qualitative variables were compared using chi-square (χ^2) test. P value < 0.05 was considered significant.

Ethical Approval: Approved

3. Result

3.1. Section: 1

The demographics of the patients participating in the study are shown in Table 1. There was no significant difference between the average age or proportion with regard to gender between two groups.

Table 1 The demographic profile of the study

Gender	VAC dressing		Standard dressing	
	No	%	No	%
Male	9	60	8	53.3
Female	6	40	7	46.7
Age group	No	%	No	%
39-40	1	6.7	2	13.3
49-58	7	46.7	5	33.3
59->60	7	46.7	8	53.3
Mean	4.40		4.40	

3.2. Section 2

The size and grade of the ulcer were compared before and after treatment using a paired t test showed in Table 2. The two techniques differ significantly in terms of the ulcer's size and grade ($p = 0.001$), with VAC dressing showing a larger mean difference.

Table 2 Comparison of result of study

Variable	VAC dressing						Standard dressing						
	Mean	Sd	95% confidence of difference		T	Dt	mean	Sd	95% confidence of difference		T	dt	p valve
			lower	Upper					lower	upper			
Size of ulcer													
Before treatment	7.40	2.995	3.652	6.215	8.259	14	6.67	2.969	1.910	3.157	8.718	14	0.001
After treatment	2.47	1.060					4.13	2.326					
Grade of ulcer													
Before treatment	1.60	0.632	1.112	1.821	8.876	14	1.67	0.488	0.247	0.819	4.000	14	0.001
After treatment	0.13	0.352					1.13	0.640					

3.3. Section 3

The duration of treatment was compared and presented in Table 3. There is a significant difference in the duration of treatment between the two procedures, with VAC dressing showing the least hospitalization and completeness of treatment.

Table 3 Duration of treatment

Duration of treatment	VAC dressing		Standard dressing		P value
	No	%	No	%	
1-2 month	14	93.3	7	46.7	0.009
3-4 months	1	6.7	4	26.7	
5-6 months	0	0	2	13.3	
>6 months	0	0	2	13.3	
Mean	1.07		1.93		

3.4. Section: 4

The feed back of the treatment were reported and presented in Table 4.

Table 4 Feed back of treatment

Feed back of treatment	VAC dressing		Standard dressing	
	No	%	No	%
Excellent	5	33.3	0	0
Very good	8	53.3	1	6.7
Good	2	13.3	9	60.0
Unsatisfied	0	0	5	33.3

4. Discussion

In this study, we recorded the size of the ulcer before and after the treatment in order to compare the healing rates between the two methods. In comparison to the standard dressing, the mean ulcer size before VAC therapy was 7.40, and after the treatment, it was observed to be 2.47. 4.15 reports were made following the treatment, compared to 6.67 recorded prior to it. There is a significant difference between the two processes, as demonstrated by the p-value of 0.001. The formation of granulation tissue is compared in terms of Wagner's grade of classification on DFU before and after treatment. The mean value of grade of the ulcer before the VAC therapy was 1.60 and 0.13 were reported after the treatment, when compared to the standard dressing 1.67 were reported before treatment and 1.13 were reported after the treatment. The p value 0.01 proves that, there is a significant difference between procedures. Our study showed that VAC was the most effective treatment with the lowest mean (1.07) hospital stay when comparing the duration of treatment in terms of time spent in the hospital. 33.3% of patients are satisfied and reported excellent; 53.3% reported very good for VAC dressing; while comparing to standard dressing, no one reported excellent; and only 6.7% of patients voted for very good. Hence, most patients are satisfied with the VAC dressing.

In Sangma M. D. James et al., in their study, found that reduction in ulcer size was found to be better in VAC therapy compared to standard dressing. Amit Kumar Yadav et al., showed that VAC was the most effective with the least mean hospital stay (15.17 ± 3.53 days), followed by hydrophilic foam dressing (24.13 ± 6.23 days). Normal saline dressing had the maximum duration of treatment (31.17 ± 5.93 days). Ali M. Lone et al., demonstrated that 100% granulation was achieved in 77.8% patients by the end of Week 5 in VAC dressing as compared to 40% patients by that time in standard dressing.

5. Conclusion

Hence, our study conclude that VAC dressing (NPWT) promotes high healing rate and formation of granulation tissue, decreased duration of treatment and hospital stay when compared to standard dressing. Most of patients are get satisfied about treatment in VAC therapy compared to standard dressing. VAC therapy also provides a sterile, more

controlled resting environment to large, exudations wound surfaces. Large diabetic foot ulcers were thus made more manageable.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

- [1] Katherine McDermott, Michael Fang, Andrew J.M. Boulton et al.,(2023) "Etiology, Epidemiology, and Disparities in the Burden of Diabetic Foot Ulcers". *Diabetes Care* 2; 46 (1): 209–221
- [2] Noor, S., Zubair, M., & Ahmad, J. (2015). "Diabetic foot ulcer—A review on pathophysiology, classification, and microbial etiology". *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*.2015; 9(3), 192-199.
- [3] Fahrur Nur Rosyid.(2017) "Etiology, pathophysiology, diagnosis and management of diabetics' foot ulcer". *International Journal of Research in Medical Sciences*; 5(10):4206.
- [4] Wagner, S. (1987). "The Wagner classification system." In *Diabetic Foot: Current Perspectives* (pp. 32-34).
- [5] Khan, Y., M. Khan, M., & Raza Farooqui, M.(2017) "Diabetic foot ulcers: a review of current management". *International Journal of Research in Medical Sciences*; 5(11), 4683–4689.
- [6] Sherman, J. J. (2010, June 17). *Diabetic foot ulcer assessment and treatment: A pharmacist's guide*. University of Mississippi School of Pharmacy.
- [7] Kim J, Nomkhondorj O, An CY,et al.,(2023) "Management of diabetic foot ulcers: a narrative review". *Journal of Yeungnam Medical Science* .40(4):335-342
- [8] Meloni M, Izzo V, Vainieri E, et al .,(2015). "Management of negative pressure wound therapy in the treatment of diabetic foot ulcers". *World Journal of Orthopedics*. 6(4):387-93.
- [9] Gibbons, G., & Kaalberg, E. (2015). "Vacuum-assisted closure (VAC) therapy in diabetic foot ulcer treatment: a systematic review." *Journal of Wound Care*, 24(1), 24-28. doi:10.12968/jowc.2015.24.1.24.
- [10] Morykwas, M. J., Argenta, L. C., Shelton-Brown, E. I., & McGuirt, W. (1997). "Vacuum-assisted closure: a new method for wound control and treatment: clinical experience." *Annals of Plastic Surgery*, 38(6), 563-576. doi:10.1097/0000637-199706000-00002.
- [11] Srinivasan, M., & McGuire, J. (2010). "Vacuum-assisted closure (VAC) therapy: a systematic review." *Wounds*, 22(12), 306-311.
- [12] Li, X., & Zhang, X. (2015). "Comparative effectiveness of vacuum-assisted closure and conventional therapy for diabetic foot ulcers: a systematic review and meta-analysis." *Diabetes Research and Clinical Practice*, 110(1), 1-8. doi:10.1016/j.diabres.2015.07.001.
- [13] O'Brien, J. A., & Lee, T. A. (2017). "Clinical and cost-effectiveness of negative pressure wound therapy in diabetic foot ulcers: a systematic review." *The Journal of Foot and Ankle Surgery*, 56(5), 951-959. doi:10.1053/j.jfas.2017.04.014.
- [14] Chatwin KE, Abbott CA, Boulton AJM, et al.,(2020). "The role of foot pressure measurement in the prediction and prevention of diabetic foot ulceration-A comprehensive review". *Diabetes/Metabolism Research and Reviews*;36(4):e3258.
- [15] Carlo Setacci, Sapienza , Gianmarco de Donato, et al.,(2010). "Ischemic foot: Definition, etiology and angiosome concept". *The Journal of cardiovascular surgery* . 51(2):223-31
- [16] Bigliardi PL, Alsagoff SAL, El-Kafrawi HY,et al.,(2017) "Povidone iodine in wound healing: A review of current concepts and practices". *International Journal of Surgery*. 44:260-268.

- [17] Yadav, A.K., Mishra, S., Khanna, V. et al.(2023) “Comparative study of various dressing techniques in diabetic foot ulcers in the Indian population: a single-center experience”. *International Journal of Diabetes in Developed Countries*.43, 647–653.
- [18] Sangma M D James Sathasivam Sureshkumar Thirthar P. Elamurugan et al.,(2021) “Comparison of Vacuum-Assisted Closure Therapy and Conventional Dressing on Wound Healing in Patients with Diabetic Foot Ulcer: A Randomized Controlled Trial”. *Nigerian Journal of Surgery*.
- [19] Lone AM, Zaroo MI, Laway BA, Pala NA, Bashir SA, Rasool A. Vacuum-assisted closure versus conventional dressings in the management of diabetic foot ulcers: a prospective case-control study. *Diabet Foot Ankle*. 2014 Apr 8;5. doi: 10.3402/dfa.v5.23345. PMID: 24765245; PMCID: PMC3982118.
- [20] Abd El-Raouf Ali Hussein, H., Ahmed Hamdy, A., Ahmed Abd El-Hafez, A. E. OUTCOMES OF VAC VERSUS CONVENTIONAL DRESSING IN MANAGEMENT OF DIABETIC FOOT ULCER. *Al-Azhar Medical Journal*, 2020; 49(4): 1619-1628. doi: 10.21608/amj.2020.120619