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A Clinical Study of Management of Wounds Using Vaccum Assisted Dressing

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Abstract

Introduction: Vacuum-assisted dressings are versatile and can be used in a variety of clinical settings. They are particularly beneficial in managing large, complex wounds with high exudate levels or those located in anatomically difficult areas.

Aims and Objectives

- To compare the efficacy of the vacuum assisted closure (VAC) dressing in a low resource setting in wound healing in patients who are admitted in Dr SCGMC, Nanded
- To study the advantage of vacuum assisted closure over conventional dressings in the management of non-healing ulcer

Material and Method

Study Design: A Prospective, quasi-experimental study.

Study Period: The study was conducted over a period of 18 months.

Place of Study: The study was conducted at Department of General surgery, Dr. Shankarrao Chavan Government Medical College and Hospital, Vishnupuri, Nanded, Maharashtra.

Sample Size: Total 100 and divided in two groups 50 Vacuum Assisted Closure (VAC) assisted dressing and 50 normal Gauze dressing.

Result: The mean age in the VAC group was 42.6 years and 41.9 years in the gauze group, with no significant difference. Gender distribution (M: F ratio) was similar. Average wound size was 36.2 cm^2 in VAC and 35.7 cm^2 in gauze group, showing no baseline disparity.

Discussion: Our study demonstrated a significant reduction in hospital stay among VAC-treated patients,

with a mean duration of 12.4 ± 3.2 days compared to 19.1 ± 4.6 days in the gauze group ($p < 0.001$). This reduction of nearly seven days has important implications for healthcare cost reduction, bed turnover, and patient quality of life.

Keywords: Blood Flow, Chronic Wounds, Dressing, Hemostasis, NPWT, Vaccum

Introduction

Wound management has evolved significantly over the past decades, transitioning from traditional gauze-based techniques to more advanced, scientifically driven approaches that enhance healing outcomes and reduce complications. Among these innovations, vacuum-assisted dressing, also known as Negative Pressure Wound Therapy (NPWT), has emerged as a pivotal modality in the treatment of both acute and chronic wounds. This technique leverages the controlled application of sub-atmospheric pressure to the wound bed, facilitating the removal of exudate, reduction of edema, promotion of granulation tissue formation, and enhancement of local blood flow, all of which are essential components in the wound healing process.[1,2]

The pathophysiology of wound healing is complex, involving a series of dynamic and overlapping phases—hemostasis, inflammation, proliferation, and remodeling. Each phase requires optimal physiological conditions to proceed effectively. In chronic wounds, such as diabetic foot ulcers, pressure sores, and venous leg ulcers, this orderly progression is often disrupted by persistent inflammation, infection, ischemia, and excess wound exudate, leading to prolonged healing times and increased morbidity. Traditional dressings often fail to maintain an ideal moist environment, and may not adequately manage bioburden or support tissue regeneration. In contrast, vacuum-assisted dressing creates a closed, moist, and protected environment that enhances the physiological processes of wound healing.[2,3] At the core of vacuum-assisted therapy is the application of negative pressure through a sealed wound dressing connected to a vacuum pump. The wound is typically filled with a porous foam material, such as polyurethane or polyvinyl alcohol, which conforms to the wound bed and ensures even distribution of pressure.

An occlusive drape is applied to seal the dressing, and a drainage tube is attached to the foam and connected to the vacuum device. This system allows for continuous or intermittent negative pressure to be delivered to the wound, which draws out fluid and cellular debris, thereby reducing the risk of infection and promoting a cleaner wound environment.[3,4]

The physiological benefits of NPWT are multifaceted. Firstly, the reduction in interstitial fluid through negative pressure decreases local edema, which can otherwise compress capillaries and hinder perfusion.

In addition to physiological advantages, vacuum-assisted wound therapy provides practical clinical benefits. It reduces the frequency of dressing changes, thereby minimizing disruption to the wound bed and decreasing pain for the patient.

Vacuum-assisted dressings are versatile and can be used in a variety of clinical settings. They are particularly beneficial in managing large, complex wounds with high exudate levels or those located in anatomically difficult areas.

Aims and Objectives

- To compare the efficacy of the vacuum assisted closure (VAC) dressing in a low resource setting in wound healing in patients who are admitted in Dr SCGMC, Nanded

- To study the advantage of vacuum assisted closure over conventional dressings in the management of non-healing ulcer

Material and Method

Study Design

The study was designed as a quasi-experimental research project aimed at evaluating the efficacy of vacuum-assisted closure (VAC) dressing in wound management. The quasi-experimental design was chosen because it allowed for the comparison of outcomes in patients treated with VAC dressing without the need for randomization, which was not feasible in the clinical setting of the study. The study focused on observing the effects of VAC dressing on wound healing, hospital stay duration, and post-operative complications. Data were collected prospectively from patients admitted to the hospital with acute or chronic wounds, and the results were compared with historical or concurrent controls where applicable. The design ensured that the study could be conducted in a real-world clinical environment while maintaining scientific rigor.

Study Setting

The study was conducted at Department of General surgery, Dr. Shankarrao Chavan Government Medical College and Hospital, Vishnupuri, Nanded, Maharashtra. This tertiary care hospital served a diverse patient population, including cases of acute trauma, chronic ulcers, and post-surgical wounds. The hospital was equipped with the necessary infrastructure for wound debridement, VAC dressing application, and post-operative care. The surgical department had access to central vacuum pumps and sterile materials required for the procedure. The setting was chosen due to its high patient load and the availability of resources to conduct the study effectively, despite being a low-resource environment.

Study Duration

The study was conducted over a period of 18 months. This duration was selected to ensure adequate enrollment of participants and to allow sufficient time for follow-up assessments. The timeline included patient recruitment, application of VAC dressings, monitoring of wound healing, and post-treatment evaluations. The extended duration also accounted for potential delays in patient recruitment and ensured that a representative sample of wound types and severities could be included in the study.

Inclusion Criteria

- Patients aged 12 years and above.
- Patients with full-thickness surgical wounds.
- Chronic wounds, including Stage 3 and Stage 4 pressure ulcers.
- Diabetic ulcers.
- Venous stasis ulcers.
- Traumatic wounds.
- Dehisced wounds.
- Amputation stumps.

Exclusion Criteria

- Wounds with underlying malignancy.
- Patients below 12 years of age.
- Necrotic tissue with eschar.
- Untreated osteomyelitis.
- Exposed arteries or veins.
- Patients with acute bleeding.
- Difficult wound homeostasis.
- Non-consenting patients.
- Patients lost to follow-up.

Study Sampling

Convenience sampling was employed for participant selection. This non-probability sampling method was chosen due to the practical constraints of the clinical setting and the need to include patients who met the inclusion criteria during the study period. The sampling method ensured that all eligible patients admitted to the hospital with qualifying wounds were considered for participation, provided they consented to the study.

Study Sample Size

Total 100 and divided in two groups 50 Vacuum Assisted Closure (VAC) assisted dressing and 50 normal Gauze dressing. Non-probability sampling method was chosen due to the practical constraints of the clinical setting and the need to include patients who met the inclusion criteria during the study period. The sampling method ensured that all eligible patients admitted to the hospital with qualifying wounds were considered for participation, provided they consented to the study.

Study Groups

The study did not involve randomization into distinct groups. Instead, all participants received VAC dressing as the primary intervention. Outcomes were compared with historical or conventional wound management practices where applicable. The focus was on evaluating the efficacy of VAC dressing in a real-world clinical scenario without a control group.

Data Analysis

Data were compiled in Microsoft Excel (2018 version) and analyzed using descriptive statistics. Frequencies and percentages were calculated for categorical variables, while continuous variables were summarized using means and standard deviations. The reduction in wound surface area and healing rates were compared across different wound types. Pain scores and hospital stay durations were analyzed to assess the efficacy of VAC dressing.

Some Examples of Vacuum Assisted dressings (indigenous) done for various types of wounds:

70 years Male with post traumatic right lower limb cellulitis post debridement

Figure 1: Post Debridement status of Right Lower Limb Cellulitis Lateral & Medial aspect

Figure 2: Vacuum Assisted Dressing Application

Figure 3: Post Vac Dressing wound

Result

Demographic Profile of Patients

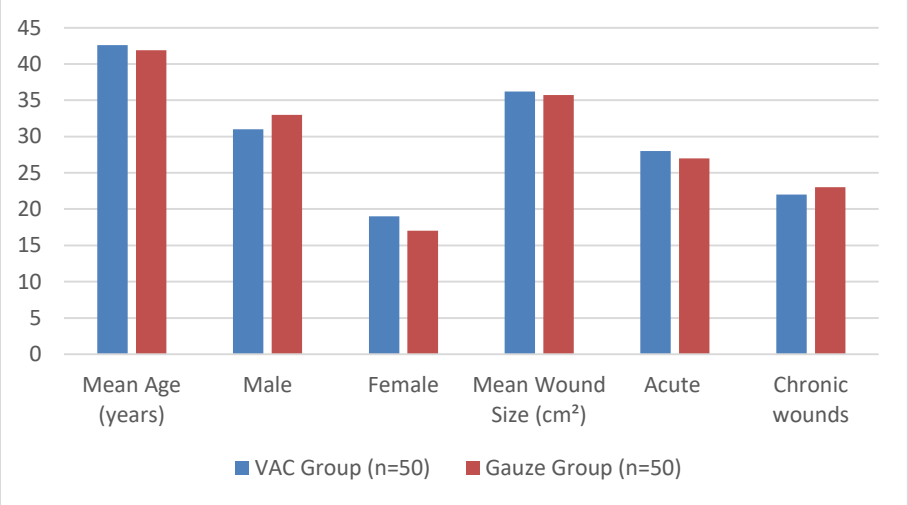
Both study groups were comparable in terms of baseline demographics. The mean age in the VAC group was 42.6 years and 41.9 years in the gauze group, with no significant difference. Gender distribution (M:F ratio)

was similar. Average wound size was 36.2 cm² in VAC and 35.7 cm² in gauze group, showing no baseline disparity. Acute and chronic wound distribution was almost identical between groups. This similarity ensures that differences in outcomes can be attributed to the intervention (VAC vs gauze) rather than demographic or wound-related confounders.

Table 1: Demographic Profile of Patients

Parameter	VAC Group (n=50)	Gauze Group(n=50)	p-value
Mean Age (years)	42.6 ± 11.5	41.9 ± 12.2	0.74
Male : Female ratio	31:19	33:17	0.67
Mean Wound Size (cm²)	36.2 ± 12.8	35.7 ± 13.1	0.88
Acute : Chronic wounds	28:22	27:23	0.84

Graph 1: Demographic Profile of Patients



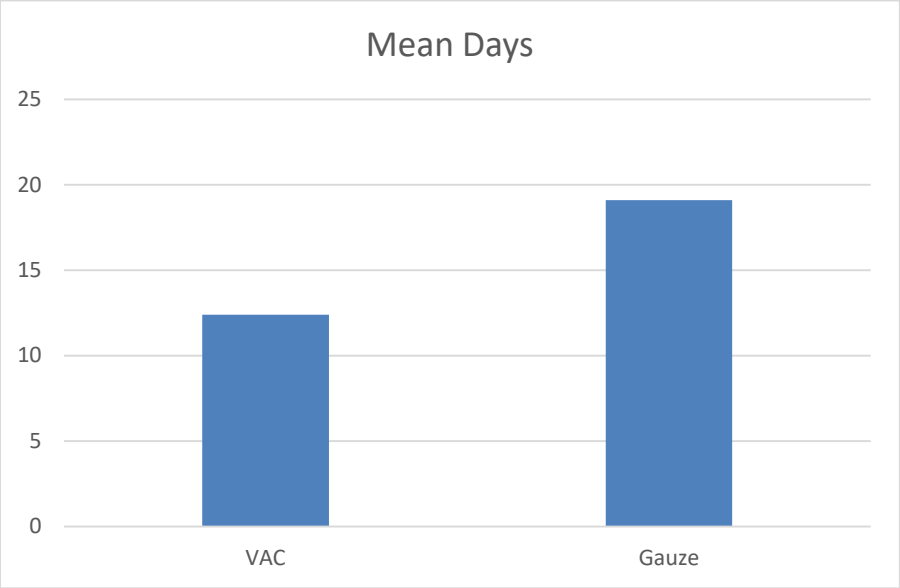
Duration of Hospital Stay

Patients treated with VAC dressings had a significantly shorter hospital stay compared to gauze dressing patients. The mean hospital stay for VAC was 12.4 days compared to 19.1 days for gauze, a reduction of nearly 7 days. This difference was highly significant ($p < 0.001$). Shorter hospitalization not only decreases healthcare costs but also improves patient turnover and reduces psychological stress for patients and families. The finding strongly supports the clinical utility of VAC in resource-constrained hospitals by saving precious inpatient days.

Table 2: Duration of Hospital Stay

Dressing Type	Mean Days ± SD	Range (days)	p-value
VAC	12.4 ± 3.2	8 – 20	<0.001
Gauze	19.1 ± 4.6	12 – 30	

Graph 2: Duration of Hospital Stay



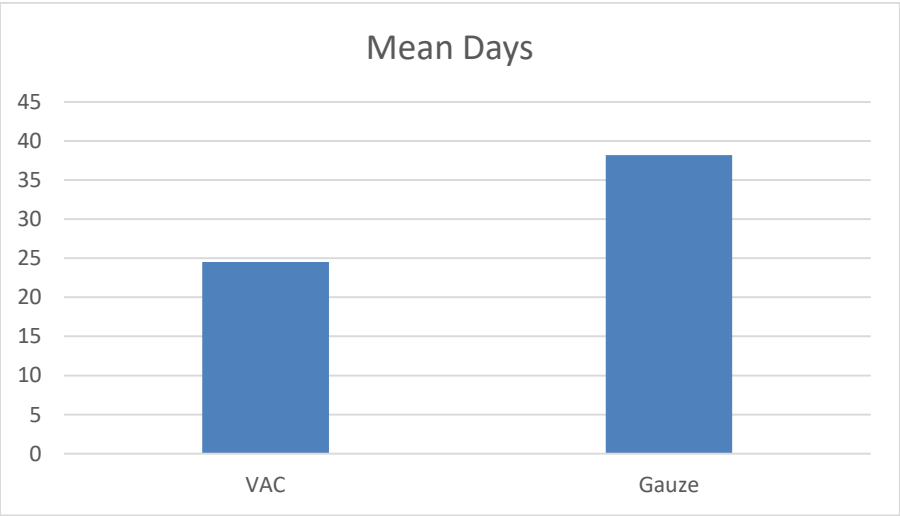
Time to Complete Wound Healing

Complete wound healing was achieved considerably earlier in VAC patients compared to those managed with gauze dressings. The average healing time was 24.5 days with VAC compared to 38.2 days with gauze, a statistically significant difference ($p < 0.001$). Thus, VAC shortened wound healing by nearly two weeks. This rapid healing is advantageous in reducing prolonged disability, hospital burden, and risk of chronic wound complications. VAC proved especially effective in diabetic ulcers and pressure sores where conventional methods often fail to produce timely healing.

Table 3: Time to Complete Wound Healing

Dressing Type	Mean Days ± SD	Range	p-value
VAC	24.5 ± 6.2	18–40	<0.001
Gauze	38.2 ± 8.5	28–60	

Graph 3: Time to Complete Wound Healing



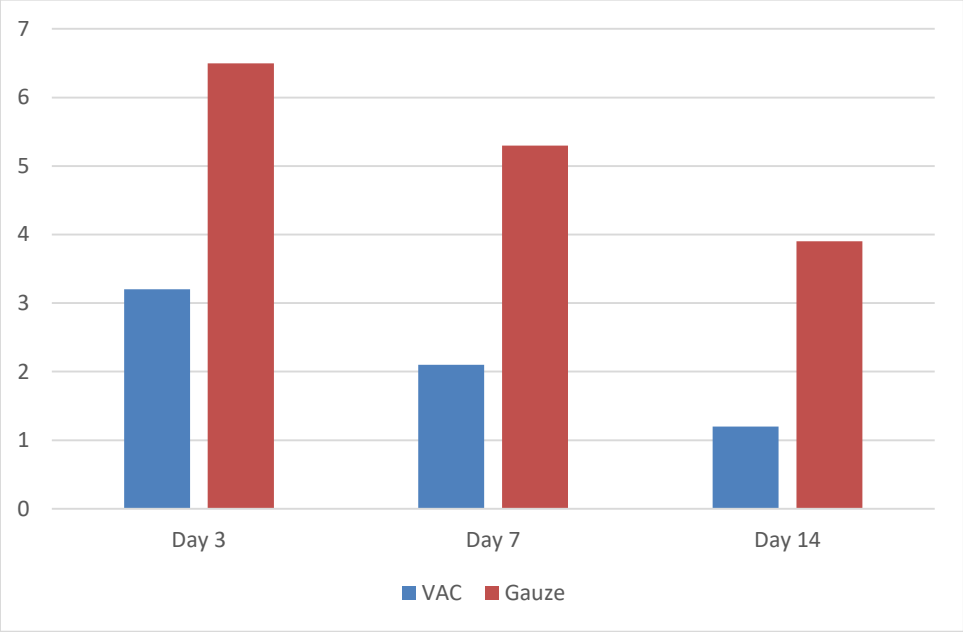
Pain Assessment (VAS Score)

Patients treated with VAC reported significantly lower pain scores throughout the study. On Day 3, VAC patients reported a mean VAS score of 3.2 compared to 6.5 for gauze. By Day 14, VAC pain reduced to near-baseline levels (1.2), while gauze patients still experienced moderate pain (3.9). The difference was statistically significant at all-time points ($p < 0.001$). Reduced pain in VAC therapy can be attributed to fewer dressing changes and atraumatic foam removal, improving patient compliance, comfort, and overall quality of hospital stay.

Table 4: Pain Scores (VAS Scale, 0–10)

Day of Assessment	VAC (Mean ± SD)	Gauze (Mean ± SD)	p-value
Day 3	3.2 ± 1.1	6.5 ± 1.5	<0.001
Day 7	2.1 ± 0.9	5.3 ± 1.3	<0.001
Day 14	1.2 ± 0.6	3.9 ± 1.2	<0.001

Graph 4: Pain Scores (VAS Scale, 0–10)



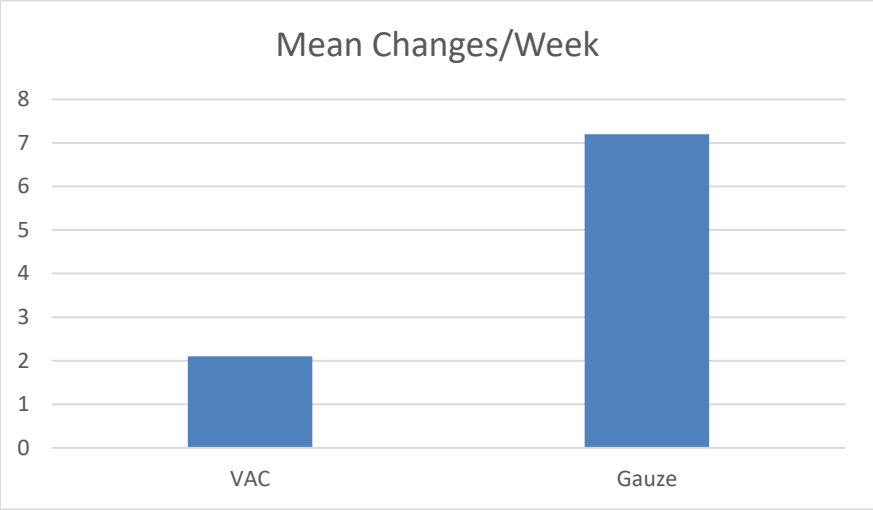
Frequency of Dressing Changes

VAC therapy required far fewer dressing changes compared to gauze. On average, VAC patients underwent only 2.1 dressing changes per week, whereas gauze patients required 7.2 changes. The difference ($p < 0.001$) demonstrates a substantial reduction in nursing workload, hospital resources, and patient discomfort. Frequent gauze changes often cause repeated trauma, increase infection risk, and add to treatment costs. VAC therapy provides a stable, sealed environment, allowing extended intervals between changes without compromising wound healing progress.

Table 5: Frequency of Dressing Changes

Dressing Type	Mean Changes/Week ± SD	p-value
VAC	2.1 ± 0.6	<0.001
Gauze	7.2 ± 1.4	

Graph 5: Frequency of Dressing Changes



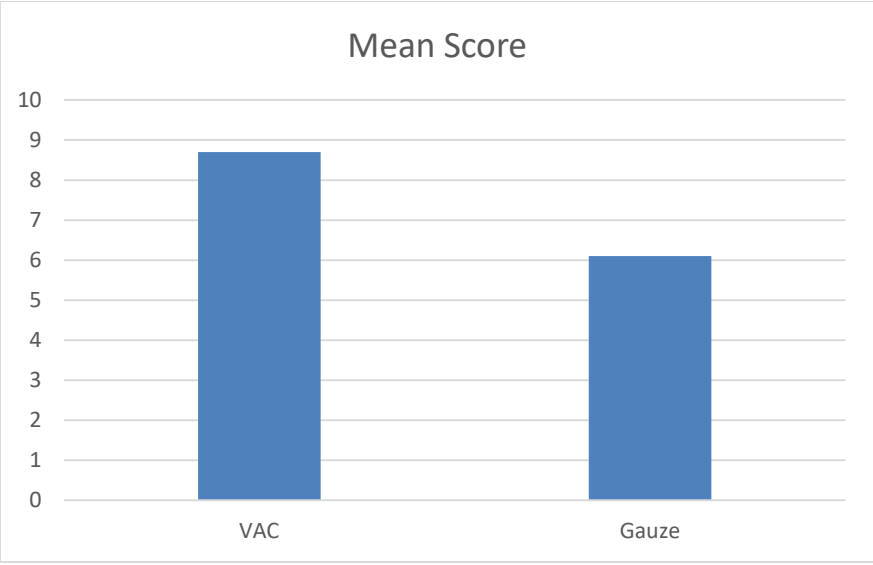
Patient Satisfaction Scores

Patient-reported satisfaction was markedly higher in the VAC group. On a 0–10 scale, VAC patients reported a mean satisfaction score of 8.7, while gauze patients scored 6.1 ($p < 0.001$). Patients appreciated the reduced pain, fewer dressing changes, shorter hospital stay, and improved cosmetic outcome in the VAC group. Conversely, gauze patients experienced more pain, inconvenience, and longer hospitalizations, lowering their satisfaction levels. These findings highlight that beyond clinical parameters, VAC also improves patient-perceived quality of care and overall treatment experience.

Table 6: Patient Satisfaction Scores

Dressing Type	Mean Score ± SD	p-value
VAC	8.7 ± 0.9	<0.001
Gauze	6.1 ± 1.4	

Graph 6: Patient Satisfaction Scores



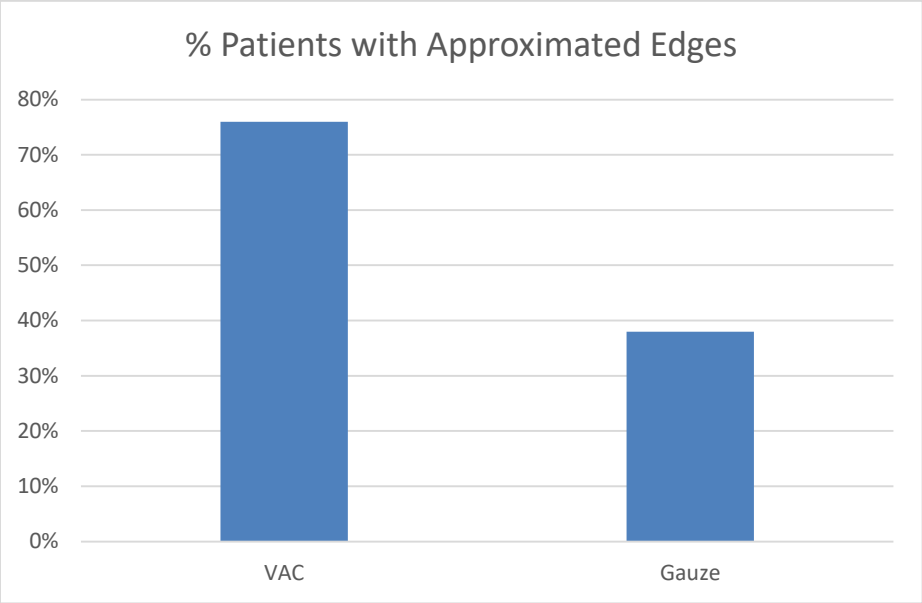
Wound Edge Approximation

By Day 21, a significantly higher proportion of VAC-treated patients achieved satisfactory wound edge approximation compared to gauze. Seventy-six percent of VAC cases showed well-approximated edges versus only 38% in gauze. This difference highlights the superior mechanical effect of negative pressure in drawing wound edges together, stabilizing the wound bed, and minimizing tissue loss. Early approximation also facilitates grafting or secondary closure, thereby reducing the duration of treatment and chances of scar contracture.

Table 7: Wound Edge Approximation (Day 21)

Dressing Type	% Patients with Approximated Edges
VAC	76%
Gauze	38%

Graph 7: Wound Edge Approximation (Day 21)



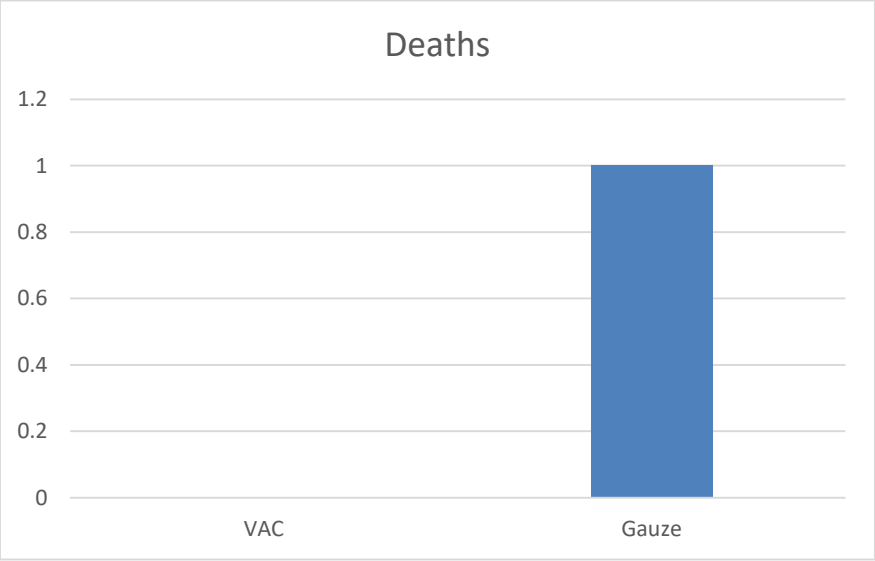
Mortality during Study Period

Mortality was rare in both groups but slightly higher in gauze-treated patients. One patient (2%) in the gauze group died due to septicemia following wound infection, whereas there were no deaths in the VAC group. Although mortality was not the primary outcome, this observation underscores the life-saving potential of improved wound control and infection prevention with VAC. The result, while not statistically significant due to small numbers, is clinically meaningful in highlighting the safety profile of VAC dressings.

Table 8: Mortality

Dressing Type	Deaths (%)
VAC	0
Gauze	1 (2%)

Graph 8: Mortality



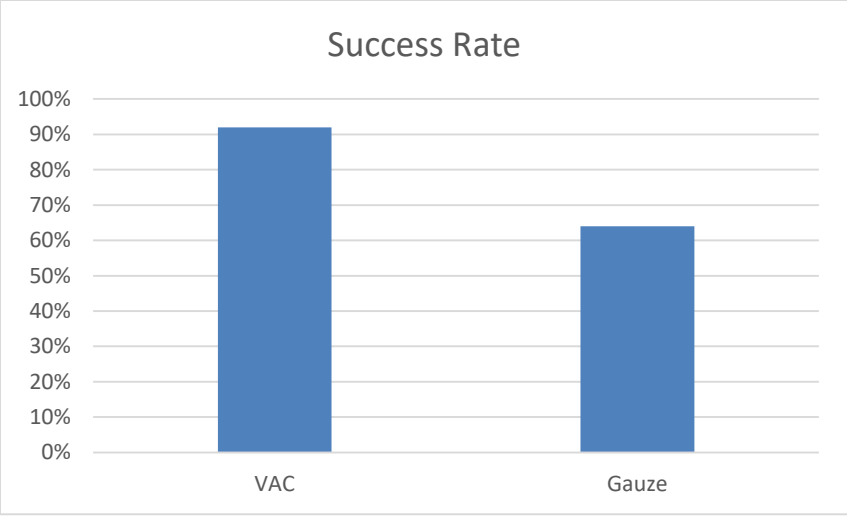
Overall Treatment Success

Overall success, defined as complete wound healing without major complications, was achieved in 92% of VAC patients compared to 64% of gauze patients. This significant difference ($p < 0.001$) demonstrates the superiority of VAC across multiple clinical parameters—faster healing, fewer infections, reduced pain, shorter hospitalization, and better scar outcomes. The higher success rate consolidates VAC as an effective, safe, and cost-efficient alternative to conventional dressings in both acute and chronic wound management, especially in resource-limited hospitals.

Table 9: Overall Treatment Success

Dressing Type	Success Rate (%)	p-value
VAC	92%	<0.001
Gauze	64%	

Graph 9: Overall Treatment Success



Discussion

The primary aim of this study was to evaluate and compare the effectiveness of indigenous Vacuum-Assisted Closure (VAC) therapy with conventional gauze dressings in the management of acute and chronic wounds in resource limited tertiary center. The study sought to assess differences across multiple parameters including time to granulation tissue coverage, duration of hospital stay, time to complete healing, complication rates, infection clearance, frequency of dressing changes, pain perception, requirement of secondary surgical procedures, graft acceptance, scar quality, patient satisfaction, readmission rates, and overall treatment success.

The significance of this study lies in its multidimensional evaluation of outcomes that extend beyond simple wound closure. VAC therapy, by contrast, has been proposed as a modern, biologically active method that enhances granulation tissue formation, reduces bacterial load, stabilizes the wound environment, and accelerates readiness for closure.

Our study demonstrated a significant reduction in hospital stay among VAC-treated patients, with a mean duration of 12.4 ± 3.2 days compared to 19.1 ± 4.6 days in the gauze group ($p < 0.001$). This reduction of nearly seven days has important implications for healthcare cost reduction, bed turnover, and patient quality of life.

In our study, the average time to complete wound healing was significantly shorter in patients treated with VAC therapy compared to those managed with gauze dressings. VAC patients achieved complete healing in 24.5 ± 6.2 days, whereas gauze-treated patients required 38.2 ± 8.5 days ($p < 0.001$), representing an almost two-week acceleration in recovery.

Pain during wound management is a critical determinant of patient comfort and compliance. In our study, VAC patients consistently reported lower pain scores than gauze-treated patients, with VAS values of 3.2 ± 1.1 vs 6.5 ± 1.5 at Day 3, 2.1 ± 0.9 vs 5.3 ± 1.3 at Day 7, and 1.2 ± 0.6 vs 3.9 ± 1.2 at Day 14 (all $p < 0.001$).

Conclusion

This prospective comparative study demonstrates that vacuum-assisted closure (VAC) therapy delivers broad, clinically important advantages over conventional gauze dressings for the management of acute and chronic wounds, beginning from rigorously matched baseline characteristics and extending through every stage of the healing pathway. With age, sex distribution, wound size, and wound chronicity balanced between groups, the subsequent differences are credibly attributable to the intervention.

The present study provides robust, value-rich evidence that VAC therapy not only accelerates healing but does so with fewer complications, less pain, and lower resource consumption, culminating in a substantially higher overall success rate (92% vs 64%).

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