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Original Research Article

OBSERVATIONAL STUDY BETWEEN VAC DRESSING AND WET TO MOIST DRESSING IN THE MANAGEMENT OF DIFFICULT WOUNDS

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ABSTRACT

Background: Difficult and chronic wounds remain a major challenge in clinical practice, necessitating advanced treatment modalities for optimal healing. Negative pressure wound therapy (VAC dressing) has been increasingly utilized as an alternative to conventional wet to moist dressing, but comparative data in diverse wound etiologies is limited. The objective is to compare the effectiveness of VAC dressing versus wet to moist dressing in the management of difficult wounds with respect to healing time, wound contraction, granulation tissue formation, number of dressings, hospital stay, and direct costs.

Materials and Methods: This prospective observational study was conducted at a tertiary care hospital, enrolling 40 patients with difficult wounds randomized equally into two groups: VAC dressing (n = 20) and wet to moist dressing (n = 20). Primary outcome was the number of days required to achieve a "ready for surgery" condition (wound bed with healthy granulation tissue, no necrosis or purulent secretion). Secondary outcomes included reduction in wound size and depth, granulation tissue formation, number of dressings required, duration of hospital stay, and direct costs. Data were analyzed using appropriate statistical tests with significance set at $p < 0.05$.

Results: The VAC group achieved a significantly shorter mean time to "ready for surgery" (14.0 ± 2.1 days) compared to the wet to moist group (18.0 ± 2.7 days; $p < 0.001$). VAC therapy resulted in greater mean wound size and depth reduction and a higher rate of complete granulation tissue formation by day 14 (85% vs 50%; $p = 0.023$). Patients in the VAC group required significantly fewer dressings (mean 5 vs 23.45; $p < 0.001$) and had a shorter hospital stay (21.0 ± 2.3 vs 26.55 ± 2.6 days; $p < 0.001$). The mean direct cost was higher in the VAC group, but may be offset by reduced resource utilization.

Conclusion: VAC dressing is more effective than wet to moist dressing for the management of difficult wounds, leading to faster wound healing, fewer dressing changes, and shorter hospital stays. While initial costs are higher, the overall benefits in patient outcomes and efficiency support the broader adoption of VAC therapy in suitable patients.

Keywords: Negative Pressure Wound Therapy; Difficult Wounds; Conventional Dressing.

INTRODUCTION

The management of wounds is a foundational aspect of surgical and medical care, tracing its evolution through centuries of medical progress. A wound represents a persistent breach in the integrity of the skin or tissues, often accompanied by disruption of structure and function. Effective wound management

involves not only closure and healing but also minimization of complications, infection, and morbidity. The approach to wound care has evolved from basic practices, such as the use of honey and lint in ancient Egypt, to modern sophisticated therapies like Negative Pressure Wound Therapy (NPWT), popularly known as Vacuum-Assisted Closure (VAC), and a range of advanced dressings.

Principles of Wound Assessment and Care

Wound assessment is the vital first step in the management process. It serves to identify the origin and effects of the wound, both on the individual and vice versa, and to determine whether healing is taking place. Proper assessment helps guide the most appropriate wound management strategies, including the selection of dressing and adjunctive therapies.

Key principles in wound management include debridement, moisture balance, bacterial balance, wound cleansing, and biofilm management:

1. **Debridement:** An essential element of wound care, debridement involves removing devitalized tissue to create a favorable environment for healing. While the empirical benefit of debridement is widely acknowledged, evidence remains mixed, though current recommendations favor regular removal of necrotic tissue—even in immunocompromised patients—to help control wound bioburden.
2. **Moisture Balance:** Maintaining an optimal moisture environment is critical for wound healing. Chronic wounds often present with excessive exudate, which can be corrosive to wound beds and surrounding skin. Dressings, negative pressure therapy, and compression are among the modalities to manage exudate and preserve moisture balance.
3. **Bacterial Balance:** All wounds harbor microorganisms; however, the host's ability to manage the bioburden determines the risk of infection and healing delays. Wound cleansing, debridement, and the use of topical/systemic antibiotics are necessary, especially in patients with risk factors like age, malnutrition, immunosuppression, or poor perfusion.
4. **Wound Cleansing:** The mainstay of wound cleansing is to remove contaminants, devitalized tissue, and debris. While saline and water remain popular, the choice of cleansing agent should be non-toxic, broad-spectrum, and compatible with dressings, facilitating the maintenance of a moist wound environment.
5. **Biofilm Infection:** Biofilms, or structured microbial communities encased in an extracellular matrix, are a common cause of chronic wound persistence and resistance to healing. Their management includes regular debridement and the use of antimicrobial dressings or systemic antibiotics as appropriate.

Evolution of Wound Dressings

Over time, wound dressing materials and techniques have continually evolved. Early practices utilized animal grease, lint, and honey, with advances in the 19th and 20th centuries seeing the introduction of sterilized gauze, antiseptics, and more recently, polymer-based dressings. In the 1990s, Negative Pressure Wound Therapy (NPWT) revolutionized chronic wound management by harnessing controlled sub-atmospheric pressure to promote healing. This approach, commercialized as VAC therapy, not only supports wound closure but also enhances granulation tissue formation, reduces edema, and removes exudate and infectious materials.

Negative Pressure Wound Therapy (VAC) versus Wet to Moist Dressing

Negative Pressure Wound Therapy (VAC):VAC involves applying a sealed foam dressing to the wound and using a vacuum pump to apply continuous or intermittent negative pressure (typically -75 to -125 mm Hg). This approach brings several advantages:

- Macrodeformation (drawing wound edges together and reducing wound area)
- Microdeformation (cellular stimulation, improved perfusion, and granulation)
- Removal of exudate and reduction of bacterial load
- Maintenance of a moist wound environment
- Reduction of edema

VAC has become a widely accepted adjunct in the treatment of acute and chronic wounds, including diabetic foot ulcers, traumatic wounds, pressure sores, and post-surgical wounds.

Wet to Moist Dressing: This conventional method uses saline-soaked gauze dressings changed frequently to maintain a moist environment, promoting autolytic debridement and preventing the wound bed from drying out. While cost-effective and widely practiced, wet to moist dressings may require frequent changes, are less effective in exudate management, and can cause maceration or pain during removal.

Aim: To compare the effectiveness of negative pressure wound therapy (VAC) versus conventional wet to moist dressing in the management of infected chronic wounds.

Objectives

1. To compare the number of days required to achieve a “ready for surgery condition” (wound bed with healthy granulation tissue, without necrosis or purulent secretion) between VAC and wet to moist dressing.
2. To compare wound bed area contraction, granulation tissue growth, and reduction in wound size and depth between the two methods.
3. To evaluate and compare the direct costs and number of dressings required for each method in the management of difficult wounds.

MATERIALS AND METHODS

Source of Data: The study was conducted at the Department of Surgery, SSG Hospital, Vadodara, including patients admitted with difficult wounds requiring specialized management.

Study Design: This was a prospective, randomized controlled, time-bound observational study.
Study Location: Department of Surgery, SSG Hospital, Vadodara, Gujarat, India.
Study Duration: From the date of Ethics Committee approval up to August 2024.
Sample Size: A total of 40 patients were included, with 20 patients randomized to each study arm (VAC group and wet to moist dressing group).

Inclusion Criteria

- Patients of both genders above the age of 13 years.
- Open wounds on the trunk or limbs.
- Wounds inflicted by mechanical trauma—accidentally or surgically.
- Wounds involving skin and underlying soft tissues only.
- Wound area ranging from 50 cm^2 to 200 cm^2.

Exclusion Criteria

- Systemic infection (e.g., UTI, pneumonia).
- Serum albumin < 3.0 gm/dl.
- Presence of renal, pulmonary, or other chronic diseases requiring ongoing therapy for stabilization; uncontrolled diabetes, thyroid disease, or hypertension.
- Ongoing systemic steroids, immunosuppressive therapy, or anticoagulants.
- Pregnant or breastfeeding patients.
- Osteomyelitis as determined by bone biopsy.
- Patients unable or unwilling to cooperate with dressing changes.
- Malignancy or neoplastic diseases at wound margin.
- Scalp wounds.

Procedure and Methodology

- All eligible patients admitted with difficult wounds were assessed and randomized into two groups by lottery method: one for VAC and one for wet to moist dressing.
- Nutritional assessment and supplementation (including zinc and multivitamins) were provided to all patients.
- Initial sharp surgical debridement of necrotic tissue and slough was performed for all wounds.
- Baseline wound measurement and photography were done.
- VAC Group:
  - Polyurethane foam, trimmed to the wound, was applied after cleaning.
  - A non-collapsible drainage tube embedded in the foam was connected to a vacuum suction machine.
  - An airtight sterile adhesive drape sealed the dressing, and negative pressure of -125 mmHg was continuously applied.
  - The dressing was maintained for 3 to 5 days, unless interrupted by tube detachment, patient discomfort, or dressing soakage.
  - On removal, foam was soaked with saline for easier removal and analgesics were administered as required.
  - Wound assessment and photography were repeated at each change.
  - Collection systems were disinfected after each use.
- Wet to Moist Dressing Group:
  - Wound cleaned with normal saline and povidone iodine.
  - Saline-soaked gauze dressing was applied and changed twice daily.
  - Wound measurement and assessment at each dressing change.
- All patients received appropriate antibiotic therapy as per wound culture sensitivity and standard blood glucose monitoring and control (with insulin as needed).
- Regular wound cultures (every 3 days) were performed.
- Study endpoint was reached when the wound bed was 100% covered with healthy granulation tissue, minimal secretion, and no slough, and was suitable for secondary closure or grafting.

Sample Processing

- Wound cultures were processed to identify bacterial flora and guide antibiotic therapy.
- Laboratory investigations included CBC, random blood sugar, blood urea, serum creatinine, chest X-ray, HIV and HBsAg serology, and pus culture sensitivity.

Statistical Methods

- Data were analyzed using appropriate statistical software (MedCalc).
- Continuous variables (e.g., wound size reduction, hospital stay) were compared using independent t-tests when normally distributed, or Mann-Whitney tests if not.
- Proportions were compared using chi-square tests or Fisher's exact test.
- Statistical significance was set at $p < 0.05$.

Data Collection

- Data were prospectively collected using a structured proforma.
- Parameters recorded included demographics, wound etiology and characteristics, wound size/depth reduction, granulation tissue formation, number of dressings required, duration of hospital stay, complications, and method of wound closure.

RESULTS

The baseline characteristics of patients enrolled in both the VAC (Negative Pressure Wound Therapy) and Wet to Moist Dressing groups were comparable, ensuring the validity of the study outcomes. In the VAC group, there were 13 males (65%) and 7 females (35%), while the Wet to Moist group comprised 14 males (70%) and 6 females (30%). This slight difference was not statistically significant ($\chi^2 = 0.11$, $p = 0.739$). The mean age was also similar between the two groups, with the VAC group averaging 40.1 years (±15.8) and the Wet to Moist

group averaging 41.3 years (±16.1), and no significant difference noted (t = 0.23, 95% CI: -5.7 to 8.1, p = 0.821). Regarding wound etiology, diabetic ulcers were the most frequent in both groups, accounting for 50% in the VAC arm and 40% in the Wet to Moist arm (p = 0.51). Traumatic ulcers, infective ulcers, and pressure sores were similarly distributed between groups, with no significant intergroup differences.

Table 1: Baseline Characteristics and Demographics (n = 20 per group)

Variable	VAC Group (n=20)	Wet to Moist Group (n=20)	Test of Significance	95% CI	P Value
Male, n (%)	13 (65%)	14 (70%)	$\chi^2 = 0.11$	-	0.739
Female, n (%)	7 (35%)	6 (30%)	-	-	-
Mean Age (years)	40.1 (±15.8)	41.3 (±16.1)	t = 0.23	-5.7 to 8.1	0.821
Diabetic Ulcer, n (%)	10 (50%)	8 (40%)	$\chi^2 = 0.44$	-	0.51
Traumatic Ulcer, n (%)	4 (20%)	5 (25%)	-	-	-
Infective Ulcer, n (%)	5 (25%)	5 (25%)	-	-	-
Pressure Sores, n (%)	1 (5%)	2 (10%)	-	-	-

Table 2: Days Required to Achieve "Ready for Surgery Condition"

Variable	VAC Group (n=20)	Wet to Moist Group (n=20)	Test of Significance	95% CI	P Value
Mean days to "ready for surgery"	14.0 (±2.1)	18.0 (±2.7)	t = 5.19	2.35 to 5.65	<0.001

VAC group reached readiness for surgery significantly earlier than the Wet to Moist group.

Patients managed with VAC dressing achieved a "ready for surgery" condition, defined as a wound bed covered with healthy granulation tissue, free of necrosis or purulent secretion, significantly faster than those managed with conventional wet to moist dressing. The mean number of days required to reach this milestone was 14.0 (±2.1) days in the VAC group compared to 18.0 (±2.7) days in the Wet to Moist group. This difference was highly statistically significant (t = 5.19, 95% CI: 2.35 to 5.65, p < 0.001).

Table 3: Wound Area Contraction, Granulation, and Depth Reduction

Parameter	Timepoint	VAC Group (n=20)	Wet to Moist Group (n=20)	Test of Significance	95% CI	P Value
Mean wound size reduction (cm^2)	Day 14	1.88 (±0.13)	1.60 (±0.12)	t = 2.65	0.06–0.49	0.012
Mean depth reduction (cm)	Day 14	2.19 (±0.15)	1.60 (±0.10)	t = 3.27	0.23–0.95	0.002
Complete granulation achieved n (%)	Day 14	17 (85%)	10 (50%)	$\chi^2 = 5.14$	-	0.023

VAC showed greater wound contraction, depth reduction, and granulation than Wet to Moist.

Analysis of wound healing parameters over 14 days showed that VAC therapy provided superior outcomes compared to wet to moist dressing. The mean wound size reduction was significantly greater in the VAC group (1.88 cm^2 ±0.13) than in the Wet to Moist group (1.60 cm^2 ±0.12), with a statistically significant difference (t = 2.65, 95% CI: 0.06–0.49, p = 0.012). Similarly, the mean reduction in wound depth was 2.19 cm (±0.15) in the VAC group versus 1.60 cm (±0.10) in the Wet to Moist group (t = 3.27, 95% CI: 0.23–0.95, p = 0.002). Additionally, a higher proportion of patients in the VAC group achieved complete granulation of the wound bed by day 14 (85% vs 50%, $\chi^2 = 5.14$, p = 0.023).

Table 4: Direct Cost and Number of Dressings Required

Parameter	VAC Group (n=20)	Wet to Moist Group (n=20)	Test of Significance	95% CI	P Value
Mean number of dressings (14 days)	5 (±1.1)	23.45 (±2.5)	t = 31.5	16.5–20.5	<0.001
Mean hospital stay (days)	21.0 (±2.3)	26.55 (±2.6)	t = 6.44	3.8–7.2	<0.001
Mean direct cost (INR)	4100 (±340)	3600 (±280)	t = 4.21	220–680	0.001

The comparison of direct resource utilization revealed significant differences between the two groups. Patients treated with VAC therapy required substantially fewer dressings over 14 days, with a mean of 5 dressings (±1.1) compared to 23.45 (±2.5) in the Wet to Moist group (t = 31.5, 95% CI: 16.5–20.5, p < 0.001). Hospital stay was also shorter for the VAC group, averaging 21.0 days (±2.3) versus 26.55 days (±2.6) for Wet to Moist (t = 6.44, 95% CI: 3.8–7.2, p < 0.001), highlighting the efficiency of VAC in promoting faster recovery. Interestingly, the mean direct cost for VAC therapy was higher (INR 4100 ±340) compared to wet to moist dressing (INR 3600 ±280), and this difference was statistically significant (t = 4.21, 95% CI: 220–680, p = 0.001).

DISCUSSION

[Table 1] Baseline Characteristics and Demographics: The demographic distribution in the

present study demonstrates a comparable allocation of age, sex, and etiology of wounds between the VAC and wet to moist dressing groups, minimizing confounding factors. Similar to our findings, Powers JGet al,[6] (2016) also included mixed wound etiologies, ensuring external validity of their results. The mean age in both groups aligns with other studies that have evaluated wound management in adult populations, such as Slavkovic Met al,[7] (2023) who reported a mean age of approximately 50 years in their cohort of diabetic foot ulcer patients. The male predominance seen in our study is also consistent with Muneer Met al. (2019),[8] who noted a higher incidence of chronic wounds among males, likely related to occupational and behavioral risk factors. The distribution of diabetic ulcers as the most common etiology matches the findings from Budhiraja Uet al. (2019),[9] who reported diabetic wounds as the leading cause of chronic ulcers requiring advanced therapies.

[Table 2] Days Required to Achieve "Ready for Surgery Condition": Our study demonstrated a statistically significant reduction in the mean number of days to reach a “ready for surgery” wound bed in the VAC group (14.0 days) compared to the wet to moist group (18.0 days). These results mirror those of Slavkovic Met al (2023),[7] who first reported that negative pressure therapy accelerates granulation and wound bed preparation in animal and clinical models. Aisa Jet al. (2022),[10] in a multicenter randomized trial, found that VAC therapy reduced time to wound closure in diabetic foot ulcers by approximately 30% when compared to moist wound care. Muneer Met al (2019),[8] also reported shorter healing times with VAC in lower extremity wounds. The rapid achievement of a suitable wound bed is clinically significant, as it can decrease the risk of secondary infection and improve overall patient outcomes.

[Table 3] Wound Area Contraction, Granulation, and Depth Reduction: The current study revealed superior wound contraction, depth reduction, and granulation tissue formation with VAC therapy over wet to moist dressing, with statistically significant differences. This is in concordance with the work of Dissemond Jet al (2022),[11] who observed enhanced granulation and wound contraction in the VAC group. In a comparative trial, Rezvani Ghomi Eet al. (2019),[12] demonstrated that negative pressure wound therapy led to greater wound surface area reduction and faster granulation tissue formation compared to conventional care. Additionally, studies by Sood Aet al (2014),[13] have documented improved quality and speed of granulation with VAC, substantiating our findings.

[Table 4] Direct Cost and Number of Dressings Required: A major advantage observed in our study was the significant reduction in the number of dressings and length of hospital stay for the VAC group, although the direct cost per patient was higher. This observation is in line with Jamaludin TSet al. (2020),[14] who noted that while initial VAC therapy costs are higher, the reduced number of dressing changes and shorter hospitalizations can lead to cost-effectiveness in the long run. Singh Ket al. (2021),[15] reported that NPWT resulted in fewer dressing changes and a shorter treatment period, leading to similar or even reduced total costs compared to standard moist wound care. Aisa Jet al. (2022),[10] also highlighted that cost considerations should include not just material costs but also indirect costs such as nursing time and hospital resources, both of which are favorably impacted by VAC therap.

CONCLUSION

The present observational study comparing negative pressure wound therapy (VAC dressing) with conventional wet to moist dressing in the management of difficult wounds demonstrates that VAC therapy offers significant advantages in terms of wound healing outcomes and efficiency. Patients treated with VAC dressing achieved faster wound bed preparation suitable for surgical intervention, greater wound size and depth reduction, and more rapid granulation tissue formation compared to those managed with wet to moist dressing. Additionally, VAC therapy was associated with significantly fewer dressing changes and a shorter duration of hospital stay, though the initial direct costs were slightly higher. These findings suggest that VAC therapy is a superior modality for promoting wound healing and optimizing resource utilization in patients with complex and chronic wounds. However, cost-effectiveness should be evaluated in the context of reduced hospitalization and dressing frequency, which may offset the higher initial expenditure. Based on these results, VAC dressing should be considered a preferred option for the management of difficult wounds, particularly in settings where rapid healing and efficient patient turnover are priorities.

Limitations

1. The study sample size was relatively small (n = 20 per group), which may limit the generalizability of the findings.
2. The study was conducted at a single tertiary care center, and results may not be directly applicable to other healthcare settings or patient populations.
3. The follow-up period was limited to the duration required to achieve “ready for surgery” condition and did not include long-term wound closure or recurrence rates.
4. The direct cost analysis did not account for long-term costs, quality of life, or indirect costs such as caregiver burden and loss of productivity.
5. Variations in wound etiology, patient comorbidities, and nutritional status, while controlled for as much as possible, could still have influenced healing outcomes.

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