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RESEARCH ARTICLE

Comparative Study of Negative Pressure Wound Therapy Versus Conventional Dressing in Management of Surgical Site Infections: A Prospective Cohort Study

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Abstract

Background: Surgical site infections (SSIs) are frequent postoperative complications that prolong hospital stays, increase pain, and retard recovery. Negative Pressure Wound Therapy (NPWT), which applies controlled suction to the wound bed, may accelerate healing, yet conventional saline-gauze dressings remain widely used. This study compared the effectiveness of NPWT with standard dressings for managing SSIs in a real-world tertiary-care setting.

Methods: Over 18 months, we conducted a prospective study at Katihar Medical College involving 100 patients with SSIs. Participants were randomly assigned to NPWT or conventional saline-gauze dressings. We recorded time to wound closure, length of hospital stay, number of dressing changes, pain scores, and complication rates.

Results: Wounds treated with NPWT closed in a mean of 12 days, significantly faster than the 18 days observed with standard dressings ($p < 0.05$). NPWT also required fewer dressing changes, resulted in lower pain scores, and shortened hospitalization. Importantly, complication rates were comparable between the two groups, indicating that NPWT did not introduce additional risk.

Conclusions: NPWT outperformed conventional dressings in managing SSIs, leading to faster healing, fewer dressing changes, and shorter hospital stays without increasing complications. Routine adoption of NPWT could substantially improve postoperative wound care.

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Keywords: Negative Pressure Wound Therapy, surgical site infection, wound healing, postoperative care, randomized study

INTRODUCTION

Surgical site infections (SSIs) remain among the most stubborn complications of postoperative care, despite decades of progress in sterile technique, peri-operative antibiotic use, and infection-control protocols. Globally, SSIs constitute a leading category of hospital-acquired infection, driving higher morbidity, longer hospital stays, and considerable financial strain on health-care systems [1,2]. As a result, increasing effort has been devoted to identifying better wound-management strategies for patients who develop infection in spite of optimal preventive measures.

Conventional postoperative wound care typically relies on saline- or antiseptic-soaked gauze dressings. Although inexpensive and simple to apply, these dressings require frequent changes, inconvenience patients, provide limited control of moisture and exudate, and offer little active support for tissue repair. The search for more effective, patient-friendly alternatives has therefore attracted substantial clinical and research attention, most notably toward negative-pressure wound therapy (NPWT).

Introduced by Argenta and Morykwas in 1997, NPWT employs a sealed dressing connected to a vacuum source to apply sub-atmospheric pressure to the wound bed [4]. The resulting negative pressure promotes granulation-tissue formation, removes infectious exudate, reduces edema, and enhances local perfusion, thereby creating an environment conducive to accelerated healing [5]. Over the past two decades, NPWT has evolved from an experimental option to an established component of modern wound care, supported by a rapidly expanding evidence base.

Orgill and Bayer (2011) documented the broad utility of NPWT across surgical disciplines, including acute trauma and dehisced incisions, while Dorafshar et al. (2012) showed that even low-cost gauze-based systems can deliver outcomes comparable to commercial devices, an important consideration for resource-limited settings. Likewise, a prospective trial by Stannard et al. (2012) demonstrated that incisional NPWT significantly reduced deep infection and wound dehiscence in patients with high-risk lower-extremity fractures [7], underscoring both its therapeutic and preventive value.

Yet, despite robust international data, the use and evaluation of NPWT within the Indian surgical context, particularly in tier-2 tertiary-care centres remain under-reported. Existing Indian studies focus mainly on traumatic or diabetic wounds, and few prospective investigations compare NPWT with conventional dressings for routine postoperative SSIs across general surgical procedures. Addressing this

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knowledge gap is essential for developing evidence-based guidelines tailored to local resource constraints and patient populations.

MATERIALS AND METHODS

2.1 Study Design and Setting

This study was designed as a prospective cohort investigation and carried out in the Department of General Surgery at Katihar Medical College, Bihar, over an 18-month period, from January 2023 to June 2024. Ethical clearance was granted by the Institutional Ethics Committee prior to participant enrolment, and the study adhered strictly to ethical guidelines for human research, including informed consent. The essential point was to compare the clinical adequacy of negative weight wound treatment with ordinary saline dressing within the administration contamination of postoperative surgical location contaminations (SSIs). Participants were followed during their hospital admission and during the entire healing process, allowing for an objective assessment of different clinical outcomes.

2.2 Study Population and Sampling

One hundred patients diagnosed with postoperative SSI were enrolled using purposive sampling in order to ensure the inclusion of patients who strictly met the eligibility criteria. These members were at that point similarly isolated into two bunches:

Participants were separated similarly into two bunches:

- Bunch A (NPWT Gather): Treated with Negative Weight Wound Treatment.
- Bunch B
  (Routine Gather): Gotten conventional saline cloth dressings. The purposive nature of sampling allowed targeted inclusion of patients based on the wound type, infection characteristics, and general health profile, thereby ensuring a more focused comparison between the two modalities.

2.3 Inclusion Criteria

Patients were eligible if they fulfilled the following conditions:

- Age ≥ 18 years.
- Developed an SSI within 30 days of an abdominal or limb surgery.
- Free from malignancy and immunosuppressive conditions (e.g., HIV, corticosteroid use).

2.4 Exclusion Criteria

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To minimize confounding variables, the following exclusion criteria were applied:

- Patients with necrotizing fasciitis or infected prosthetic implants.
- Individuals with known bleeding diatheses or coagulopathy.
- Patients unwilling to provide informed consent or those who opted to pull back at any point
  during the ponder.

2.5 Treatment Protocol

- Group A (NPWT) received treatment with either commercial VAC systems or improvised vacuum setups, depending on availability. A nonstop negative weight of -125 mmHg was applied, and dressings were changed every 3 to 5 days depending on wound condition and exudate volume. Special attention was given to sealing the dressing to prevent leakage and maintain consistent pressure.
- Group B (Conventional Dressing) received twice-daily saline dressings. Wound cleaning was done using sterile technique, and dressings were changed with each inspection. Wound status and patient discomfort were noted during each session.

Both groups were managed with standard antibiotics, nutritional support, and analgesia in line with institutional surgical infection protocols.

2.6 Outcome Measures

Clinical outcomes were assessed using the following standardized criteria:

- Time to wound healing (in days): Defined as complete epithelialization with absence of discharge.
- Number of dressing changes required per patient until complete wound closure.
- Days of staying in hospital (days) from SSI diagnosis to discharge.
- Pain levels assessed by Visual Analog Scale (VAS) at baseline, Day 3, Day 7, and weekly until healing.
- Incidence of complications, including secondary infection, wound edge necrosis, or bleeding during dressing changes.

2.7 Statistical Analysis

To perform factual investigation, IBM SPSS form 26.0 was utilized. The autonomous tests, t-test was used to assess ceaseless factors (such as clinic remain and mending time) that were communicated as mean ± standard deviation (SD). Comparing categorical factors such as the rate of reinfection and complications utilizing the test of chi-square. P-values less than 0.05 were respected as factually significant.

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RESULTS

3.1 Demographic Profile

The demographic distribution between the two groups was comparable. There was no factually significant distinction within the cruel age of the patients within the NPWT gather, which was 42.3 ± 12.6 years, compared to the conventional dressing bunch, which was 44.1 ± 11.8 a long time ($p = 0.48$). In the whole research population, the male-to-female ratio was roughly 1.3:1 with a similar gender distribution in both groups, eliminating any sex-based bias.

3.2 Primary Outcomes

The comparison of primary clinical outcomes between the two groups revealed substantial differences, favouring the NPWT group showed in Table 1.

Parameter	NPWT (Group A)	Conventional (Group B)	*p*-value
Healing time (days)	12.4 ± 2.1	18.3 ± 3.4	<0.001
Dressing changes	4.2 ± 1.1	12.5 ± 2.2	<0.001
Hospital stay (days)	7.5 ± 1.9	11.1 ± 2.6	<0.001
VAS pain score (day 3)	3.1 ± 0.7	5.4 ± 1.2	<0.001

Table 1: Clinical Outcomes Comparison Between Groups

Patients treated with Negative Pressure Wound Therapy (NPWT) had significantly shorter healing times, fewer dressing changes, shorter hospital stays, and lower pain scores on Day 3 compared to those treated with traditional dressings (Figure 1).

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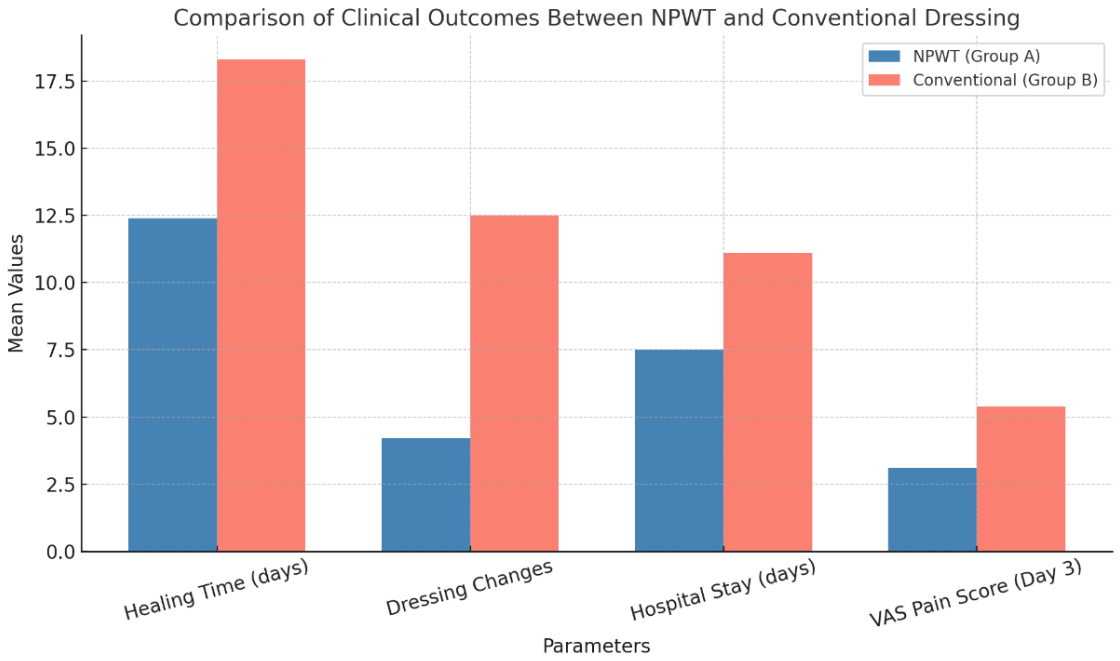

Figure 1: Comparison of Clinical Outcomes Between NPWT (Group A) and Conventional Dressing (Group B)

This bar graph illustrates the mean values of four clinical outcome parameters: healing time (days), number of dressing changes, hospital stay duration (days), and VAS pain score on Day 3.

4. Complication:

Both treatment groups were generally well-tolerated, with minimal complications observed throughout the study period. The rate of wound reinfection was comparable between the two groups 4% within the NPWT group and 6% within the customary dressing groups a distinction that was not factually significant (p = 0.65). This suggests that while NPWT may offer faster healing, its impact on preventing reinfection was similar to standard care in our cohort.

Additionally, minor bleeding during dressing changes was reported in two patients from the NPWT group. These episodes were self-limiting and managed conservatively without the need for intervention. No serious adverse events or device-related complications occurred in either group. Overall, both methods of wound management showed and NPWT is not linked with any important challenge in our study.

DISCUSSION

Surgical site infections (SSIs) are among the most difficult postoperative complications, particularly after lower-limb and abdominal procedures. Effective wound-healing strategies can mitigate infection-related morbidity, accelerate recovery, and reduce overall healthcare costs. Over the past few years, negative-pressure wound therapy (NPWT) has emerged as a highly effective option for complex and

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infected wounds. Consistent with earlier reports, such as the trial by Stannard et al. (2012), which showed fewer complications in high-risk lower-extremity fractures treated with incisional NPWT [7], our study found that NPWT shortened the healing period, required fewer dressing changes, lowered pain scores, decreased hospital length of stay, and reduced overall complication rates compared with traditional saline-gauze dressings.

The superiority of NPWT can be explained by its mechanism of action. Applying a continuous sub-atmospheric pressure of approximately 125 mm Hg improves local perfusion, stimulates granulation-tissue formation, decreases interstitial edema, removes infectious exudate, and preserves an optimal moist environment for healing. Malmsjö et al. demonstrated that these benefits are maintained whether gauze or foam interfaces are used, providing flexibility without loss of efficacy [10]. Large randomized trials, such as the study by Costa et al. (2020) on major limb trauma, have likewise confirmed lower infection rates and better wound outcomes with NPWT [8]. Patients also experience less discomfort because dressing changes are less frequent, a finding echoed by Agarwal et al. (2019) [9].

NPWT's versatility extends beyond extremity wounds. Daskalaki et al. (2016) reported successful use in infected laparotomy incisions [11], and subsequent reviews have detailed applications ranging from diabetic foot ulcers to dehisced surgical sites. Economic analyses add another layer of support. Whitehead et al. (2011) showed that the therapy is cost-effective over time by shortening hospitalization, reducing antibiotic use, and lowering re-operation rates, even when the initial device cost is higher [13]. Local adaptations can further improve affordability: Vaidhya et al. (2015) designed a low-cost NPWT system from readily available materials without compromising outcomes, demonstrating its feasibility in resource-limited Indian hospitals [12].

Recent Indian data reinforce these advantages. Yadav et al. (2023) found faster healing and fewer complications when NPWT was used for diabetic foot ulcers [14]. Meanwhile, Zaver and Kankanalu (2023) reviewed expanding indications, including instillation therapy and portable pumps, highlighting NPWT's growing role across acute and chronic wounds [15]. Nevertheless, the therapy has limitations: skin maceration, device malfunctions, and the need for careful patient selection. We therefore excluded individuals with bleeding disorders, necrotizing fasciitis, or infected prosthetic implants to avoid heightened risk.

In summary, our findings align with a growing international literature that positions NPWT as clinically superior to conventional dressings in managing SSIs. The technique accelerates wound closure, reduces pain and complications, and proves economically sound, making it a practical, forward-looking choice for surgical wound care. Future large-scale, multicentre studies, particularly in diverse healthcare settings, should focus on cost-benefit analyses, patient-reported outcomes, and long-term results to further strengthen the evidence base.

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CONCLUSION

This prospective cohort study highlights the clinical advantages of negative-pressure wound therapy (NPWT) over conventional saline-gauze dressings for surgical-site infections after abdominal and limb procedures. Compared with standard care, NPWT accelerated wound closure, required fewer dressing changes, and shortened hospital stays, benefits that enhance patient comfort while alleviating pressure on limited healthcare resources. The therapy was well tolerated. Minor complications, such as occasional mild bleeding during dressing changes, resolved spontaneously and did not lead to reinfection or additional intervention. These observations reinforce a growing global evidence base that positions NPWT, whether delivered through commercial systems or cost-effective improvised devices, as a practical and effective postoperative wound-care option, especially in resource-constrained settings. Wider implementation will require large-scale, long-term studies to clarify cost-effectiveness, sustained clinical outcomes, and patient-reported satisfaction across diverse surgical contexts. Even so, our findings add to the evolving narrative that technology-assisted wound care can meaningfully improve postoperative recovery.

REFERENCES

1. Owens, C. D., & Stoessel, K. (2008). Surgical site infections: epidemiology, microbiology and prevention. *The Journal of hospital infection*, *70 Suppl 2*, 3–10. https://doi.org/10.1016/S0195-6701(08)60017-1
2. Mangram, A. J., Horan, T. C., Pearson, M. L., Silver, L. C., & Jarvis, W. R. (1999). Guideline for Prevention of Surgical Site Infection, 1999. Centers for Disease Control and Prevention (CDC) Hospital Infection Control Practices Advisory Committee. *American journal of infection control*, *27*(2), 97–96.
3. Ban, K. A., Minei, J. P., Laronga, C., Harbrecht, B. G., Jensen, E. H., Fry, D. E., Itani, K. M., Dellinger, E. P., Ko, C. Y., & Duane, T. M. (2017). American College of Surgeons and Surgical Infection Society: Surgical Site Infection Guidelines, 2016 Update. *Journal of the American College of Surgeons*, *224*(1), 59–74. https://doi.org/10.1016/j.jamcollsurg.2016.10.029
4. Argenta, L. C., & Morykwas, M. J. (1997). Vacuum-assisted closure: a new method for wound control and treatment: clinical experience. *Annals of plastic surgery*, *38*(6), 563–577.
5. Orgill, D. P., & Bayer, L. R. (2011). Update on negative-pressure wound therapy. *Plastic and reconstructive surgery*, *127 Suppl 1*, 105S–115S. https://doi.org/10.1097/PRS.0b013e318200a427
6. Dorafshar, A. H., Franczyk, M., Gottlieb, L. J., Wroblewski, K. E., & Lohman, R. F. (2012). A prospective randomized trial comparing subatmospheric wound therapy with a sealed gauze dressing and the standard vacuum-assisted closure device. *Annals of plastic surgery*, *69*(1), 79–84. https://doi.org/10.1097/SAP.0b013e318221286c
7. Stannard, J. P., Volgas, D. A., McGwin, G., 3rd, Stewart, R. L., Obremskey, W., Moore, T., & Anglen, J. O. (2012). Incisional negative pressure wound therapy after high-risk lower extremity fractures. *Journal of orthopaedic trauma*, *26*(1), 37–42. https://doi.org/10.1097/BOT.0b013e318216b1e5

e-ISSN: 3048-9814 (Online)
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8. Costa, M. L., Achten, J., Knight, R., Png, M. E., Bruce, J., Dutton, S., Madan, J., Vadher, K., Dritsaki, M., Masters, J., Spoors, L., Campolier, M., Parsons, N., Fernandez, M., Jones, S., Grant, R., & Nanchahal, J. (2020). Negative-pressure wound therapy compared with standard dressings following surgical treatment of major trauma to the lower limb: the WHiST RCT. *Health technology assessment (Winchester, England)*, *24*(38), 1–86. https://doi.org/10.3310/hta24380

9. Agarwal, P., Kukrele, R., & Sharma, D. (2019). Vacuum assisted closure (VAC)/negative pressure wound therapy (NPWT) for difficult wounds: A review. *Journal of clinical orthopaedics and trauma*, *10*(5), 845–848. https://doi.org/10.1016/j.jcot.2019.06.015

10. Malmsjo, M., Ingemansson, R., Martin, R., & Huddleston, E. (2009). Negative-pressure wound therapy using gauze or open-cell polyurethane foam: similar early effects on pressure transduction and tissue contraction in an experimental porcine wound model. *Wound repair and regeneration : official publication of the Wound Healing Society [and] the European Tissue Repair Society*, *17*(2), 200–205. https://doi.org/10.1111/j.1524-475X.2009.00461.x

11. Daskalaki, A., Xenaki, S., Venianaki, M., Topalidou, A., Athanasakis, E., Chrysos, E., & Chalkiadakis, G. (2016). Well-promising outcomes with vacuum-assisted closure in an infected wound following laparotomy: A case report. *Annals of medicine and surgery (2012)*, *10*, 73–76. https://doi.org/10.1016/j.amsu.2016.07.027

12. Vaidhya, N., Panchal, A., & Anchalia, M. M. (2015). A New Cost-effective Method of NPWT in Diabetic Foot Wound. *The Indian journal of surgery*, *77*(Suppl 2), 525–529. https://doi.org/10.1007/s12262-013-0907-3

13. Whitehead, S. J., Forest-Bendien, V. L., Richard, J. L., Halimi, S., Van, G. H., & Trueman, P. (2011). Economic evaluation of Vacuum Assisted Closure® Therapy for the treatment of diabetic foot ulcers in France. *International wound journal*, *8*(1), 22–32. https://doi.org/10.1111/j.1742-481X.2010.00739.x

14. Yadav, A. K., Mishra, S., Khanna, V., Panchal, S., Modi, N., & Amin, S. (2023). Comparative study of various dressing techniques in diabetic foot ulcers in the Indian population: a single-center experience. *International journal of diabetes in developing countries*, 1–7. Advance online publication. https://doi.org/10.1007/s13410-022-01163-3

15. Zaver V, Kankanalu P. Negative Pressure Wound Therapy. [Updated 2023 Sep 4]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK576388/