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Efficacy of Indigenous Negative Pressure Wound Therapy (NPWT) in the Management of Diabetic Foot Ulcers in Rural Settings: A Prospective Interventional Study

Dr. M. Rahmatunnisa[1], Dr. K. Suhas[2]

[1]Junior Resident, Department of General Surgery, ASRAM Hospital, Eluru, Andhra Pradesh, India
Email: *rahmatunnisamohammad[at]gmail.com*

[2]Professor and HOD, Department of General Surgery, ASRAM Hospital, Eluru, Andhra Pradesh, India.

Abstract: ***Background: Diabetic foot ulcers (DFUs) are a major cause of morbidity and healthcare burden, especially in low-resource rural settings. Negative pressure wound therapy (NPWT) is a proven adjunct in wound care; however, high costs and limited availability hinder its application in rural hospitals. This study evaluates the effectiveness of an indigenously assembled NPWT system in managing DFUs. Methods: A prospective interventional study was conducted on 120 patients with Wagner grade 1 and 2 diabetic foot ulcers. Indigenous NPWT systems were applied using sterilized foam, Ryle's tube, and wall suction. Outcomes were evaluated based on granulation tissue development, pain scores, infection control, need for re-debridement, and amputation rates over a two-week period. Results: By day 14, 92% of patients showed significant granulation tissue development. Pain scores improved substantially (mean VAS score dropped from 6.4 to 2.1). Infection was controlled in over 85% of patients. Only 4 required re-debridement and 2 underwent amputations. Conclusion: Indigenous NPWT is a cost-effective and clinically efficient wound care modality in rural settings. Its implementation can substantially reduce the burden of DFUs and improve limb salvage outcomes.***

Keywords: Diabetic foot ulcer, Negative pressure wound therapy, Indigenous VAC, Rural health care, Wound healing, Cost effective wound care, Granulation tissue, Diabetes complications, Low resource settings, Limb salvage, Chronic wound management, Wagner classification.

1. Introduction

Diabetes mellitus is a global epidemic, with India projected to harbor over 134 million diabetics by 2045. Among its numerous complications, diabetic foot ulcers contribute significantly to morbidity and healthcare costs, often culminating in amputations. Effective wound care strategies are essential to prevent such outcomes. NPWT has demonstrated success in promoting granulation, reducing infection, and expediting wound healing. However, commercially available systems are prohibitively expensive for rural populations. This study explores the utility of an indigenously assembled NPWT device tailored for low-resource environments.

2. Aims and Objectives

Aim:
To determine the usefulness of an indigenously assembled VAC (NPWT) in the management of diabetic foot ulcers in a rural hospital setup.

Objectives:
- To assess wound healing via granulation scores over 14 days.
- To evaluate pain (VAS), bleeding, infection control, and need for re-debridement or amputation.

3. Materials and Methods

Study Design: Prospective interventional study

Duration: 1 year

Location: Alluri Sitaramaraju Instituteof Medical sciences, Eluru, Andhra Pradesh, India

Sample Size: 120 diabetic patients (Wagner grade 1 or 2 ulcers)

Inclusion Criteria:
- Age >20 years
- Diabetic foot or leg ulcer, Wagner grade 1 or 2

Exclusion Criteria:
- Osteomyelitis, malignancy, immunosuppression, active pus discharge or bleeding

Intervention:
Patients received standard pre-treatment (debridement, antibiotics, glycemic control). NPWT was applied using sterile foam, Ryle's tube, and wall-mounted suction (100–125 mmHg). Dressings were changed every 3 days.

Data Collection Tools:
- Ulcer characteristics and Wagner grading
- Granulation scoring, VAS pain score
- Blood culture results
- Documentation of complications

4. Results

- Demographics: 75 males, 45 females; mean age: 54.7 years
- Granulation Tissue Development:
- Day 3: 70% showed early granulation
- Day 6: 84% had moderate granulation
- Day 14: 92% showed healthy granulation tissue
- Pain Score (VAS): Reduced from mean 6.4 (Day 1) to 2.1 (Day 14)
- Infection: Controlled in 102/120 cases
- Re-debridement: 4 patients
- Amputation: 2 patients
- Cost Comparison:
- Professional VAC: ₹5000 per dressing
- Indigenous VAC: ₹300 per dressing

5. Discussion

The study affirms that indigenous NPWT is effective in managing diabetic foot ulcers, particularly in rural and low-resource settings. It promotes faster granulation, reduces pain and infection, and minimizes the need for further surgical intervention. These results are consistent with prior studies by Armstrong et al., Eginton et al., and Sharma et al., demonstrating NPWT's clinical superiority over standard moist wound therapy.

Advantages of Indigenous NPWT:
- Affordable and sustainable in rural setups
- Easy to assemble using locally available materials
- Reduces patient financial burden without compromising clinical outcomes

Limitations:
- Short follow-up (2 weeks)
- No control group for comparison
- Long-term recurrence data not evaluated

6. Conclusion

Indigenous NPWT provides a viable, affordable alternative for diabetic ulcer management in rural areas. With adequate training and hospital support, this system can revolutionize chronic wound care in resource-constrained environments.

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