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GLOBAL JOURNAL OF Medical and Clinical Case Reports OPEN ACCESS JOURNAL

ISSN: 2455-5282 DOI: https://dx.doi.org/10.17352/gjmccr

Case Report

Successful Treatment of Stage 4 Sacral Pressure Ulcers using Vacuum-assisted Closure Therapy

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Received: 02 January, 2025
Accepted: 06 February, 2025
Published: 07 February, 2025

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Keywords: Sacral pressure ulcer; Vacuum-assisted closure therapy

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Abstract

Pressure ulcers are a significant health issue, particularly among the elderly and immobile individuals, resulting in considerable human suffering and financial costs. They pose a clinical challenge for both healthcare providers and patients, as they can be difficult to heal, expensive to treat, with a significant negative impact on quality of life. Therefore, prevention is crucial.

Here, we report the successful treatment of a 75-year-old male patient presenting with persistent sacral pressure ulcer infection with Vacuum-Assisted Closure (VAC) therapy. This patient had a history of bedridden dementia and a previous cerebral infarction, which predisposed him to persistent deep-pressure ulcers. With effective management, he experienced clinical improvement, highlighting the importance of using VAC therapy in challenging cases.

Introduction

The term "pressure ulcer," also known as bedsore or decubitus ulcer, refers to the damage of the skin and underlying tissues caused by poor blood circulation due to prolonged pressure on the bone overlying area, which results in cell death and tissue necrosis. The skin surrounding the wound may show signs of deterioration, and the wound itself can enlarge rapidly. Pressure ulcers are often accompanied by infection due to impaired lymphatic flow, ischemia, and a disturbed immune system. A grade 4 pressure ulcer is the most severe type, characterized by extensive skin damage that significantly increases the risk of life-threatening infections [1-3].

Several factors can worsen the prognosis of pressure ulcers, including pain, unpleasant odours, local infections, co-existing health conditions, poor nutrition, diminished self-care capabilities, and systemic diseases. They contribute to the high rates of morbidity and mortality in affected individuals. Additionally, the significant costs associated with long-term treatment, dressings, specialized pressure-relieving mattresses, and the need for rehabilitation can severely affect the quality of life in these patients [1].

Pressure ulcers pose a serious health risk, particularly for the elderly and individuals with limited mobility. Seventy-one percent of those affected are over 70, emphasizing the need for proactive prevention strategies in this vulnerable age group. The higher prevalence of pressure ulcers in the elderly can be attributed to several factors, including immobility, catabolic processes, and urinary and fecal incontinence. These ulcers occur when there is constant pressure on sensitive tissues, especially in bedridden individuals [2,4]. Therefore, addressing this issue is crucial for improving health outcomes and enhancing the quality of life for older adults.

Conservative management of pressure ulcers is essential and includes pressure relief, removal of necrotic tissue (debridement), infection control, proper wound care and dressing, and reducing risk factors. Implementing these strategies can significantly improve the situation for those at

Citation: Oskay T. Successful Treatment of Stage 4 Sacral Pressure Ulcers using Vacuum-assisted Closure Therapy. Glob J Medical Clin Case Rep. 2025:12(2):042-046. Available from: https://dx.doi.org/10.17352/2455-5282.000197

risk [1]. However, prevention rather than treatment should deserve attention.

Delayed wound healing is a major concern, particularly in challenging cases and among the elderly with multiple co-morbid health conditions. It can lead to pain, increased morbidity, prolonged treatment times, and may necessitate extensive reconstructive surgery, creating a significant social and financial burden [1-4]. In recent years, Vacuum-Assisted Closure (VAC) therapy has gained widespread acceptance for treating chronic or delayed wound healing by serving as an effective alternative to traditional wound management methods. It is especially beneficial in challenging cases of chronic or delayed wound healing, and its timely use may be worth considering for critically ill patients [5,6].

VAC (VAC; *Genadyne* USA, NY Inc) therapy, also known as Negative Pressure Wound Therapy (NPWT), refers to a wound dressing system that provides subatmospheric pressure across the affected wound site. The system included a sterile sponge housed in a negative pressure device, which was connected to a vacuum hose for treatment. The device operated at a negative pressure of 125 mm Hg, following a cycle of 5 minutes on and 2 minutes off. The application of negative pressure enhances spontaneous wound healing and may reduce the need for reconstructive procedures [7,8]. This nonpharmacological and nonsurgical method of regulating wound healing was first proposed by Argenta and Morykwas in 1997 [9]. VAC therapy based on the application of topical negative pressure promotes closed wound healing by reducing edema, enhancing blood flow, and removing infectious agents and chronic inflammatory cells from the environment. By stimulating blood flow to the wound bed, it helps deliver essential leukocytes and plasma that counteract the chronic wound environment. VAC is utilized as an adjunct or alternative to surgery for a diverse range of wounds, aiming to decrease morbidity, reduce costs and hospital stays, and improve patient comfort [10-12].

Case report

A 75-year-old man was admitted to the intensive care unit due to a significant deterioration in his overall health. His condition was further complicated by dementia and sequelae of a cerebrovascular accident, which left him bedridden in a supine position and resulted in the development of a sacral pressure ulcer. Local wound care, including wet-dry and biological dressings, was applied in various settings for a year; however, the lesions gradually worsened. The patient's care was inadequate and further deteriorated by decreased mobility due to urinary and fecal incontinence and malnutrition. These health conditions led to the development of sacral pressure ulcers, moisture lesions, and a reduced capacity for healing. Consequently, the patient was referred for a dermatology consultation for further evaluation.

Upon admission to the hospital, the patient's vital signs were recorded as follows: a respiratory rate of 18 breaths per minute, a heart rate of 88 beats per minute, a blood pressure of 100/60 mm Hg, and a body temperature of 38.9 °C. During the initial hospital visit, blood tests revealed elevated levels of White Blood Cells (WBC) at 13,800 µL (N:4.000-10.000), C-Reactive Protein (CRP) at 63.552 mg/dL(N:0-5), and procalcitonin at 0.142 ng/mL(N:0-0,05). The patient showed no issues with liver and kidney function tests. In addition to fluid electrolyte treatment and empiric antibiotic therapy, complementary agents, including human albumin were given for three consecutive days to address hypoalbuminemia.

On dermatologic examination, the wound bed appeared to be a large black, mud-like necrotic area with severe maceration at the wound edge (Figures 1a,b). The patient was diagnosed with a severe stage IV ulcer infection along with accompanying sepsis. Wound cultures from the sacral region revealed the growth of Klebsiella spp. In response, intravenous therapy was continued, including meropenem 500 mg three times a day and teicoplanin 400 mg once daily for 14 days, along with amikacin 500 mg twice a day for one week. Follow-up blood tests showed that both CRP and WBC levels had returned to normal.

To maximize skin integrity, we implemented several strategies: regular repositioning, the use of an airwave mattress, maintaining stable diabetes, providing a high-protein diet, and adhering to a strict hygiene regimen. We initiated local dressing using Aquacel-Ag, a silver-impregnated antimicrobial hydrofiber dressing, as the wound contact layer. After one week of its application, the skin was easily debrided (Figures 1c,d). After carefully evaluating the patient's overall health and specific circumstances, we determined that frequent dressing changes could negatively impact stage IV ulcers. Therefore, we decided to use medical VAC® therapy to promote healing instead of standard dressings or surgical flap procedures to expedite the wound healing process.

Figure 1a,b: The necrotic ulcer before debridement. **c,d:** The deep ulcer after debridement.

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Dressing changes in the system were performed every 72 hours throughout the treatment period. VAC treatment was administered over 4 months, from June to September 2024. The wound bed was monitored clinically every two weeks apart, showing significant reductions in both circumference and depth (Figures 2a,b). By the end of the second week, necrosis and a severe odour had vanished. By the sixth week, exudate production gradually decreased, resulting in visible signs of healthy epithelialization along the edges and granulation in the wound bed and walls. Control cultures taken from the wound in the second week were sterile. After approximately 16 weeks, the overall size and depth of the wound significantly decreased (Figures 2c,d).

Discussion

We used VAC® therapy to successfully treat a deep stage 4 ulcer with sepsis in an older patient who presented late and had numerous comorbidities.

Pressure ulcers continue to be a significant source of morbidity in older patients, highlighting the critical need for effective management strategies in geriatric care. Pressure ulcers often cause significant pain and, in cases of concurrent osteomyelitis, may also be a primary source of infection for life-threatening sepsis. As a common and chronic problem in debilitated or immobile patients in hospital settings, deep pressure ulcers also pose a significant socioeconomic burden on patients, their families, and caregivers [1].

Figure 2a, b: After VAC therapy, the wound appears clean and healthy, with no signs of infection or necrosis. c,d: Significant improvement observed 16 weeks later.

Pressure ulcers are wounds that develop due to prolonged pressure on bony areas of the body. Approximately 75% of these injuries occur around the pelvic girdle, particularly at the sacrum, ischium, and greater trochanter. When external pressure exceeds the pressure within the capillaries, tissue ischemia can occur in these regions, depending on the patient's clinical condition. Due to the proximity of the sacrum to the anus, this area is highly susceptible to contamination, leading to prolonged and laborious healing, particularly in patients with urinary or fecal incontinence [4].

The significance of pressure ulcers is increasing due to the aging population. Treating pressure ulcers requires a multidisciplinary approach that includes optimizing nutrition, managing infections, improving overall medical conditions, and addressing incontinence and sources of external pressure. When managing pressure ulcers, it is crucial to tailor treatment based on the wound's stage and size. Preventive measures involve frequent repositioning of patients, ensuring adequate nutrition, and using specialized bedding and pillows. Nonetheless, pressure ulcers may still develop. In such cases, secondary preventive measures like irrigation, wound cleaning, and maintaining the wound surface-along with biological dressings-can aid in the healing process. Occasionally, simply removing nonviable or contaminated tissue may be sufficient. For advanced pressure ulcers, particularly grades III and IV, surgical intervention involving local flaps is typically necessary [2].

VAC therapy is a technique designed to speed up the healing process for both acute and chronic wounds. The main principle behind this method is to isolate the wound area completely from the external environment while maintaining a subatmospheric pressure using a specialized device. This negative pressure therapy helps stabilize the wound environment, reduces swelling and bacterial load, increases blood flow to the area, and promotes the formation of granulation tissue and new blood vessels. The greatest effect of negative pressure on the wound bed is increased blood flow, and 125 mmHg negative pressure has been shown to increase blood flow four-fold. It operates on the principle that applying negative pressure to the wound creates a better environment for healing [7,8].

It can help reduce the need for reconstructive procedures, particularly in challenging cases and among elderly patients with comorbidities, where delayed wound healing is a significant concern. One of the main benefits of VAC therapy for advanced wounds is that it uses a special kit and requires very few dressing changes, making it easier to manage infected wounds. Other effective outcomes of VAC therapy include reducing the spreading of infection, improved quality of life, improved rehabilitation, and reduced mortality [5-8].

VAC therapy has been reported effective in managing various clinical conditions, including diabetic foot ulcers, pressure ulcers, chronic wounds, and skin conditions grafts [5-15].

Ploumis and colleagues conducted a review of seven articles to investigate the role of VAC therapy in patients with spinal

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cord injuries and pressure ulcers. They found that patients who received VAC therapy experienced shorter healing times compared to those who underwent conventional treatment. Additionally, spinal cord injury patients who received negative pressure therapy showed a quicker reduction in both the size and depth of their ulcers, as well as a faster formation of granulation tissue compared to those receiving standard care. The VAC technique has been reported to be safe and easy to use at home. It is effective for treating chronic wounds in patients with spinal injuries, as well as for those with pressure ulcers resulting from diabetes, infections, and post-traumatic injuries [16].

VAC therapy for pressure ulcers has significantly reduced costs in patients by decreasing resource use, including inpatient hospitalization, antibacterial agents, and outpatient visits [17].

A study by Schwien, et al. showed that pressure wounds treated with VAC had fewer hospitalizations compared to patients treated with standard moist healing methods [18].

In a meta-analysis, Suissa and colleagues reviewed randomized controlled trials comparing NPWT to standard wound care from 1993 to 2010 and found a significant reduction in wound size and a significant reduction in wound healing time in the NPWT group compared to the standard wound care group [19]. Baynham, et al. found that sacral and ischial wounds that had been resistant to surgical treatment for the past 10 months healed in approximately 2 months with VAC [20]. Ford, et al. reported a prospective randomized trial of 28 patients with pressure ulcers in the pelvic area. However, reduced length of hospital stay, reduced costs, and improved comfort were noted in the VAC group [21].

Various flap techniques have proven effective in closing the defect in late-stage pressure ulcers but continue to have high complication and recurrence rates, resulting in additional patient discomfort and overall high costs of care and treatment. The most frequently cited factor in complications and recurrence is wound dehiscence, which is usually associated with persistent dead space in the wound cavity, shear forces along tissue planes, and accumulation of serous fluids [22,23]. Therefore, VAC therapy is critical to closing the dead space for effective healing in advanced-stage pressure ulcers, as in our patients.

Conclusion

VAC therapy was applied to these infected deep-pressure sores for 16 weeks and successful wound healing was achieved without the need for surgical intervention. This study demonstrates that VAC therapy can reduce dependency on surgery in advanced-stage pressure ulcers, speed up the healing process in difficult wounds, and improve the patient's quality of life. VAC therapy also minimizes the risks and costs associated with surgery while providing comfort to both patients and healthcare providers. Given that frequent dressing changes for sacral wounds can be challenging, VAC therapy proves to be a reliable method for treating sacral pressure ulcers when surgery is not a feasible option. Therefore, we emphasize the importance of initiating VAC therapy early in the intensive care unit for patients with persistently infected pressure ulcers.

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