



The Progress of Wound Healing during the Application of Negative Pressure Wound Therapy to a Chronic Diabetic Foot Ulcer: A Case Report

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ABSTRACT

Non-healing wounds and associated health care cost is a global burden. This issue is a great challenge for developing countries. Negative pressure wound therapy (NPWT) is a popular treatment method currently being used for chronic wound healing worldwide. NPWT is a non-invasive closed system that creates a sub-atmospheric (negative) pressure environment. This therapy is mostly utilized in patients who have chronic wounds such as pressure ulcers and diabetic wounds. NPWT reduces debris, decreases swelling of the tissues and promotes rich blood flow to the wound site. The aim of the present study was to explore the progress of wound healing with the application of NPWT to a delayed-healing diabetic foot ulcer. The case study was conducted based on data gathered through direct patient observation during the application of NPWT. The study was about a 59-year-old male person who was diagnosed with diabetes mellitus and had delayed wound healing for more than 2 months on his left lower limb foot ulcer. After applying NPWT to the delayed healing wound for seven days, the medical team observed a rapid wound healing process including redness over the wound, less debris, less amount of slough, and closure of the wound from edges gave evidence of the effectiveness of the wound healing process.

1. INTRODUCTION

Diabetes is a globally widespread disease, and surgical interventions for managing foot ulcers have become increasingly common. The major indication for admissions in patients with diabetes mellitus is foot ulcers and there is a high chance of staying a number of days in the hospital facing multiple surgical procedures and therapies during these prolonged hospital stays (Ahmed, 2002). Diabetic foot is a specific term that is used to introduce the foot with a wound of a patient with diabetes mellitus.

The most effective therapy for diabetic foot ulcers remains defined incorrectly. Placing a wet-soaked saline gauze pack on the wound site is considered a slandered method for healing diabetic wounds but, it has been difficult to keep continuous moisture with this wet dressing on the wound site. This has led to the innovation of various hydrocolloid wound gels and ointments containing moisture retention agents. The Negative Pressure Wound Therapy (NPWT) is an innovative closed therapy that promotes wound healing by removing fluid from the open wound. NPWT is a closed system method having a sealed dressing and tubing system used to remove fluid from the wound to the connected container. This device creates a sub-atmospheric pressure which is commercially called a VAC (Vacuum Assisted Closure) device (Nabuurs et al., 2005).

Limited access and high costs of NPWT devices in Sri Lanka have resulted in insufficient local data on the use of NPWT for non-healing wounds. Consequently, nurses in Sri Lanka have limited chances to acquire knowledge and practical experiences in NPWT. This study aims to bridge this gap providing valuable insight into NPWT and its role in facilitating the wound healing process. Ultimately benefiting nurses in their understanding and application of this therapy.

There is limited data relevant to NPWT locally in

Sri Lanka due to the lack of availability and high cost of NPWT devices for the treatment of non-healing wounds. Therefore, nurses have fewer opportunities to gain knowledge and experience in NPWT. This study may help nurses to be aware of the NPWT and its application to the wound healing process.

2. CASE REPORT

A 59-year-old male person, who had diabetes mellitus for 4 years and was not on regular treatment has been transferred to the surgical male ward of National Hospital Sri Lanka from a rural hospital for advanced therapy for wound debridement of an ulcer on the left lower limb. This patient had this chronic wound for a 2-month period. Initially, the patient was admitted to the rural hospital for wound care. Antibiotic therapy and hypertonic saline dressing had been applied every other day at that hospital. Then the patient was transferred to National Hospital Sri Lanka for advanced care. On admission, the patient had been diagnosed with chronic foot ulcer with osteomyelitis and exposed calcaneus. The wound had been continuously oozing and causing severe pain. Subsequently, the patient was taken to the operating theater where a wound toilet was performed, and a Betadine dressing was applied on the same day. Following the procedure, the patient began taking oral Diclofenac Sodium 50 mg twice daily for pain management. Additionally, intravenous Co-Amoxiclav 1.2 g three times daily and intravenous Clindamycin 600 mg three times daily were initiated as part of the antibiotic therapy.

On admission, the blood glucose level was 284 mg/dl. Therefore, oral Metformin 500mg bd has been started for glycemic control. A referral to a nutritionist has been done to schedule a diabetic diet as it is more important for glycemic control which supports wound healing. The wound dressing was performed every other day with hypertonic saline for 4 days. The surgical team

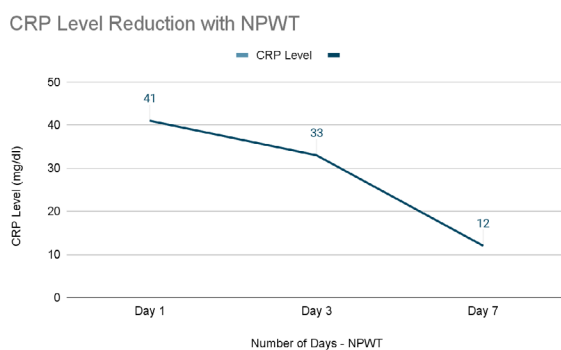
decided to apply NPWT for wound healing.



Figure 1: Before NPWT (wound site)

Figure 2: After 7 days NPWT (wound site)

On admission, C-Reactive Protein (CRP) level was 41 mg/L then it gradually decreased to 33 mg/L on day 3 after NPWT and to 12 mg/ on the seventh day after NPWT. The wound debridement fluid volume was 120 ml on day 1. Then it was reduced to 100ml on day 2. After that the fluid volume level was reduced to 80 ml on day 3 and it was about 20 ml on day 4. Then, it gradually decreased within the rest of the days to an immeasurable amount. After completing the first circle (7 days) of NPWT, the wound healing progress was assessed. The wound appeared healthy, had a reddened surface over the wound site and closed wound edges. Then, the surgical team decided to discontinue the therapy by this circle because the wound had healed well to the expected level. Then, application of daily dressing was started with hypotonic saline. After 4 days of applying dressing with hypertonic saline, the patient was discharged, and hypertonic dressing every other day was prescribed.



3. DISCUSSION

The use of advanced therapy on wound healing in the treatment of chronic wounds helps to minimize the risk of complications and infections, and enhances wound healing (Głowacz et al., 2022). Diabetic foot ulcers have a serious impact on patients' quality of life. It may especially affect physical functioning and emotional aspects (Nabuurs et al., 2022). These patients use more health resources that are costly; not only for wound dressing but also for staff costs, investigation costs and the cost of antibiotics (Diabetes UK, 2010). Patients with diabetic foot ulcers are at high risk for amputation, if the wound fails to heal, and diabetic people have a 10 to 20 times higher risk of losing a lower limb or part of a lower limb to non-traumatic amputation than people without diabetes (Morris et al., 1998). Debridement is an important treatment used for chronic wounds such as ulcers and non-healing surgical wounds. It involves the removal of dead tissues and calluses along with the pressure-relief/ off-loading treatment of infection and revascularization. The sharp (surgical) debridement of diabetic wounds is recommended in guidelines to promote wound healing by 'converting' a chronic wound to an acute wound via the removal of dead tissue and slough (Steed, 2006). Debridement of necrotic tissues of diabetic foot wounds can sometimes be a requirement prior to the use of wound treatments such as NPWT (Gabriel et al., 2009). NPWT was innovated as an effective therapy that results in rapid wound healing and form granulations (Serrano & Domínguez, 2022). The effectiveness and rapid healing of the wound caused shortened hospital stays, reduced expenses, number of re-interventions and use of staff and materials (Hortelano, 2022). The NPWT duration is less when compared to the conventional treatments (Serrano & Domínguez, 2022). Some studies have shown initial treatment with conventional techniques and then NPWT alone or combined with better results (Hortelano et al., 2006). The

study of Dowsett et al. (2022) has calculated a mean total cost per case of GBP 818 and a mean cost of GBP 24.33 for materials and GBP 13.83 for nursing care per day.

4. CONCLUSION

Diabetic foot ulcers are classified as a prominent category of open surgical wound. Nurses can have experience in managing diabetic wounds using NPWT which is one of the favored treatment options globally. NPWT is a wound healing method that is used as a closed system to remove wound debris and reduce infections. The positive experience of healthcare workers in the effectiveness of using NPWT on wound healing helps to support the increase in the use of this therapy more as patients benefit through this method. The experience of nurses on NPWT provides evidence on the effectiveness of NPWT which caused a reduction in the frequency of dressing changes and resulted in decreased workload of nurses. NPWT enhances the wound healing process and helps patients to reduce the period of hospital stay. Hospital management gains benefit from this because NPWT does not require any drug application during the treatment.

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