A simple and low-cost technique of creating a Negative Pressure Wound Therapy machine on the example of a severe phlegmon of lower limb in lower socio-economic area — a case report

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CASE REPORT

***Abstract*—The Negative Pressure Wound Therapy (NPWT) is an approved method of healing lower extremity ulcers of various origin, accelerating the wound closure process, thus decreasing the hospital-stay time and lowering the cost of the treatment. Although it is scarcely needed in developing countries such as Kenya, there is a lack of official supplier of the NPWT equipment. We present an improvised method of constructing a reliable and effective NPWT dressing from widely available tools in a case of treating a post-traumatic phlegmon in an HIV-positive patient with good outcomes. Improvised NPWT may provide an effective treatment of chronic wounds regardless of their origin and may be successfully used in low-income parts of the world.**

***Keywords*—improvised negative pressure wound therapy, negative pressure wound therapy, phlegmon**

I. Introduction

THE Negative Pressure Wound Therapy (NPWT) is an approved method of healing lower extremity ulcers of various origin, accelerating the wound closure process,[1] thus decreasing the hospital-stay time and lowering the cost of the treatment.[2] Unfortunately, many developing countries such as Kenya lack an official supplier or producer of commercial NPWT equipment. The import of such could be an option, but as the insurance or reimbursement is very limited and most of the time patients have to pay for medical care themselves,[3] it is very unlikely to become a standard of care. The goal of this case report is to demonstrate a working NPWT set using materials that are economically and commercially available in these countries.

II. Case Report

A 30-year-old man was admitted to Bishop Kioko Catholic Hospital in Machakos, Kenya with an ulceration of the left lower limb, which developed as a result of an injury that had happened a month earlier. He denied applying any dressing to the wound, nor disinfecting it. The patient complained of the itching sensation while the infection was spreading to the subcutaneous area. He decided to ask for medical care only after the ulceration started to impede his work.

On admission, the patient was in good general condition, he didn't demonstrate fever, general malaise, tachycardia nor tachypnoea. He was oriented to person, place and time. The examination of his leg revealed tenderness, swelling and increased warmth. There was an open wound in the lower third of the patient's crus with palpable subdermal abscesses and visible purulent leakage. He was diagnosed with cellulitis by the local physician. He was a known HIV-positive patient, although a CD4-count or the date of diagnosis was unknown. He denied having any other comorbidities. The patient had the subdermal abscesses drained and received an intravenous antibiotics treatment. He also had the dressings changed every 2 days.The worsening of the clinical symptoms progressed and the subdermal inflammation has spread. A week later a new diagnosis of phlegmon was proposed (Fig. 1) and a more aggressive line of treatment was introduced.

After a week of such treatment, we decided to apply a self-made NPWT dressing to accelerate the healing process. Our NPWT dressing was made of (Fig. 2):

- a typical dishwashing foam, sterilized in the steam autoclave with its upper, abrasive layer removed
- a breakfast foil, sterilized by bathing in apovidone solution for half an hour
- a surgical suction machine, with a sterilization tube.

After thorough wound bed preparation the foam was cut to fill in the biggest wound, then the suction tube was placed onto it. One person was stabilizing the tube and the other covered the whole crus with foil. A few more layers of the foil were used to ensure robustness between the foam and the suction tube. Finally, the suction tube was connected to the suction machine. Due to the foil transparency, we were able to check whether the negative pressure was properly applied. There was no evidence of leakage, thus we set the negative pressure to continuous -0.2 kPa, which is an equivalent

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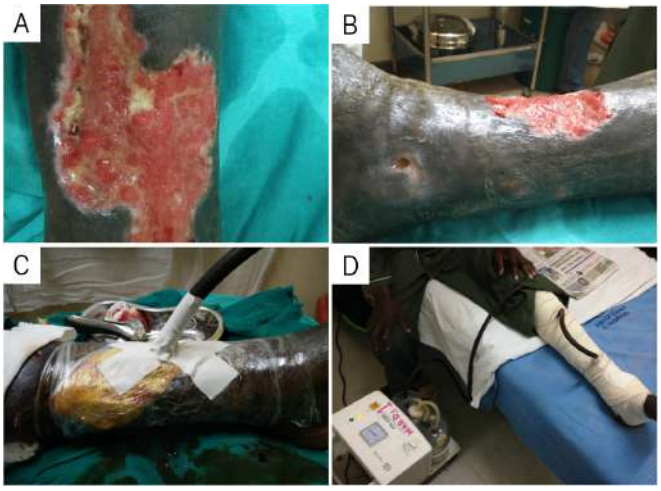

Figure 1. Components of the improvised NPWT, a dishwashing foam and a breakfast foil were used. B) Wound bed prepared for NPWT. c) A foam, breakfast foil and suction tube applied.D) A completed dressing

to -150 mmHg and observed the system for any signs of pressure drops. The patient did not report any discomfort during the treatment. He could move to the suction unit without interrupting the work of the device. 3 days later, we revised the wound and noticed a significant vascularization and granulation on over half of the wound's surface. There was less pus, the inflammation did not progress and the healing process after those 3 days was faster compared to the previous 1 week of moist dressing therapy. The exudate diminished and inflammation shrank.

The healing process was rapid and uncomplicated. The patient was discharged in a stable condition shortly afterward on his own demand. The reason was his economical status. Because of that, we could not continue our improvised NPWT. We could observe his recovery when he came every 2 days for the dressing change and debridement for the next 2 weeks until the time we had to leave Kenya (Fig. 3). Unfortunately, we could not witness his full recovery, nor had we any contact to confirm it.

III. Discussion

It has been reported that a low-cost negative pressure wound therapy can be beneficial to the patients with chronic wounds of the lower extremity in lower socioeconomic groups.[4] In comparison to our study, it was based on an Indian population and the negative pressure was achieved by connecting the suction tube to a vacuum in the wall, not to the suction machine. Despite its adequacy, it has to be stated that the study had to be withdrawn because of the lack of ethics committee approval. The lack of support from official producers is only one of many obstacles to implement NPWT in Sub- Saharan medical facilities successfully. Collection, preparation, and adjustment of the whole improvised NPWT machine lasted a whole day long. Covering the wound took almost an hour itself due to the technical difficulties. The local medical staff definitely needs a thorough training in NPWT and chronic wound therapy. However, we still believe

Figure 2. A) Anterior view of the wound. B) A view of the wound laterally. Arrow points to an abscess

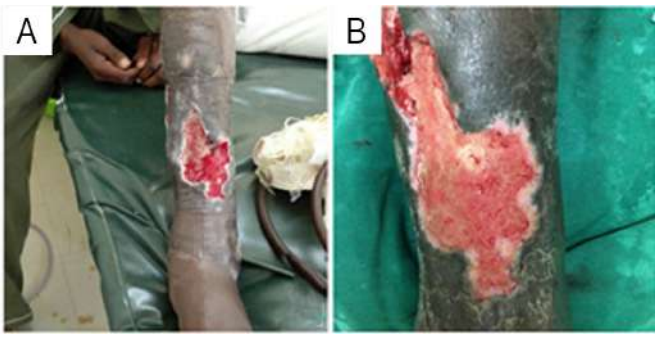

Figure 3. A) The wound after 3 days of continuous NPWT. C) The wound a week later, after debridement and dressing change.

that concerning the great percentage of diabetic foot and limb amputations,[5] pressure ulcers,[6] and a high percentage of HIV-positive individuals in Kenyan population[7] introducing the NPWT would be beneficial for patients and medical workers alike.

A limitation of this study was our inability to follow-up on the patient's recovery.

IV. Conclusions

Improvised NPWT may provide an effective treatment of chronic wounds regardless of their origin and may be successfully used in low-income parts of the world.

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