

CASE SERIES

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# The use of improvised negative pressure therapy to manage wounds in difficult situations at LAUTECH Teaching Hospital, Ogbomoso: a case series

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## Abstract

### Background

Negative pressure wound therapy (NPWT) makes use of regulated suction pressure in a localized environment to manage wounds. The high cost of the patent device has led to the development of a less expensive but comparably effective one using locally sourced materials. Creating an airtight seal is vital in making an NPWT setup functional and effective but in some conditions, this may be difficult to achieve.

### Case presentation

We present the methods of use of improvised negative pressure therapy in the difficult settings of external fixation and complete scotch cast with a window for wound dressing in two patients managed at LAUTECH Teaching Hospital, Ogbomoso. The simple use of opsite initially over the foam dressing and reinforcing it with cling film and subsequently wrapping strips of opsite around the pin sites and the potential leak sites as described in this report is very effective and with lower cost when compared with other methods.

### Conclusion

The use of cling film and opsite only in maintaining an airtight seal in difficult settings of negative pressure wound therapy is simple and cost-effective with good wound outcomes.

**Keywords:** Negative pressure wound therapy, improvised wound therapy, Vacuum-assisted closure, external fixator, wound management.

## Background

Negative pressure wound therapy (NPWT) is the use of sub-atmospheric pressure in a localized environment for the management of wounds. It accelerates wound healing in various types of wounds and it has proven to be very promising and to be beneficial in the management of difficult-to-heal wounds (1). The practice of exposing a wound to sub-atmospheric pressure was first described by Fleischmann in 1993.

However, the first reports about the use of the device came from Argenta and Morykwas in 1997 (2, 3).

The first conventional NPWT device was patented as Vacuum Assisted Closure (VAC) and introduced in 1995 in the USA. The high cost of the VAC system has led to the development of less expensive, comparably effective dressing based on the same principles by making use of the regular suction machine, nasogastric tubes

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(NG tubes), sterilized domestic foams, and the cling film wrap/opsite (4, 5). Mba et al (4) in Nigeria described their experience with the use of improvised negative pressure wound therapy in the management of wounds with exposed bone with satisfactory results in almost all the patients. Amouzou et al (6) also reported similar findings regarding its use among patients with traumatic wounds in Togo.

Securing an airtight seal is germane in making an NPWT setup functional and effective but in some conditions, this may be difficult to achieve. One such condition is in the setting of external fixation. Several methods have been tried to seal air leaks in the NPWT set up with an external fixator in-situ but certain drawbacks have been associated with them. This report has however highlighted a simple method of preventing air leaks in the external fixator using only cling film and strips of opsite. This research also further described how the difficulty of maintaining an airtight environment can be circumvented in the setting of a full cast with a window for wound dressing.

### Case presentation

*Case one (Use of NPWT with external fixator in-situ)*

This patient is a 30-year-old man who presented with an open tibiofibular fracture of the right distal leg following a road traffic crash. On examination

at presentation, he was conscious, not pale, and well hydrated. The Packed Cell Volume was 32% and the Electrolytes, urea, and creatinine were normal. He had 0.5mls of intramuscular tetanus toxoid and was commenced on Intravenous Cefuroxime, Pentazocine, and oral multivitamins. He had external fixation of the fracture and fasciocutaneous flap cover at presentation. There was distal flap necrosis which resulted in a residual wound of 11x 7cm with a 2x2cm area of exposed bone. As a result of this, he was planned for improvised negative pressure wound therapy as a secondary procedure to manage the residual wound. The materials for the procedure were sourced and the foam was sent for sterilization (Figure1). The wound was exposed and cleaned with normal saline and the pin sites were also cleaned (Figure 2). The wound size was measured and the sterile foam was trimmed to a size slightly wider than that of the wound. The Nasogastric tube was fenestrated from the tip up to 1cm short of the length of the trimmed foam and it was tunneled through the foam with the aid of artery forceps (Figures 3, 4). A little lubricating gel was dropped on the exposed bone and the wound was covered with sofratulle, povidone iodine gauze, and dry gauze. The pin sites were also dressed in povidone-iodine gauze while other exposed wounds were covered with dry gauze.



**Figure 1: shows the materials that are needed for the improvised negative pressure wound therapy arranged on a dressing trolley**



**Figure 2: shows the left leg wounds with exposed bone and external fixator in situ**



**Figure 3: shows the burrowing of the fenestrated NG tube through the sterile foam with the aid of artery forceps taken through the foam in the opposite direction**



**Figure 4: shows the fenestrated NG tube already burrowed through the trimmed sterile foam**

The foam containing the fenestrated NG tube was placed on the dressed wound and with the aid of assistance, an opsite was applied to cover and hold the foam and the dressed wound in place (Figures 5, 6). A cling film was thereafter wrapped

around the limb, further covering the wound and maintaining an airtight seal (Figure 7). The pin sites were further wrapped and covered with small pieces of opsite to improve the airtight seal. Other potential leak sites like the exit of the NG

tube and the proximal and distal ends of the airtight drape were all sealed with Opsite and adhesive plaster. The outer end of the NG tube was then connected to the suction machine which was switched on (Figure 8). With the absence of any leak site, the foam collapsed and the pressure was adjusted to 100mmHg. The patient

had 5 sessions of negative pressure wound therapy over 4 weeks with the healing of the wounds. He was discharged home two weeks after following the removal of the external fixator and application of a complete below-the-knee cast. He is currently being followed up at the Orthopaedic and Plastic Surgery outpatient clinic.



**Figure 5: Shows the application of Opsite over the dressed wound with the sterile foam in place**



**Figure 6: Shows the lower limb after the application of Opsite**



**Figure 7: shows the left lower limb after application of the cling film over the layer of Opsite drape**



**Figure 8: A functioning negative pressure wound therapy set-up connected to the suction machine**

*Case two (Use of NPWT with complete scotch cast and a window for wound dressing in situ)*

The patient is a 20-year-old lady who had a closed distal tibia fracture with a proximal 12x 6cm avulsion wound not communicating with the fracture site. She presented from another facility bearing a complete below knee scotch cast on the left leg with a window for dressing the avulsion wound. On examination at presentation, she was healthy looking, not pale, and well-hydrated. The Packed cell volume was 30%, and the retroviral screening, the HbsAg, and the anti HCV tests were negative. She was commenced on oral Cefuroxime, Eproxen, and Vitamin C. She was planned for NPWT to make the wound well vascularized before skin grafting.

The scotch cast was bivalved and the anterior part was removed leaving the back slab in situ. The wound was cleaned with normal saline and dressed in sofratulle and povidone-iodine gauze.

A sterile foam slightly larger than the size of the ulcer with a fenestrated NG tube in situ was placed on the wound and it was draped with cling film over the back slab. The cling film was taken through 4-6 rounds around the back slab to ensure firm support. The potential leak points were sealed with plaster and the outer end of the NG tube was connected to the suction machine which was switched on. The foam collapsed in the absence of an air leak and the pressure was adjusted to 100mmHg (Figure 9). After 2 sessions of NPWT over 10 days, she had split-thickness skin graft cover of the wound and external fixation of the fracture. The grafted site healed completely over three weeks. The external fixator was removed and replaced with a complete below-knee-cast six weeks after surgery and the patient was discharged home. She is currently attending Orthopaedics and Plastic Surgery outpatient clinic.



**Figure 9: A negative pressure wound therapy applied in a setting of a scotch cast showing collapsed foam**

## Discussion

NPWT is an effective and widely recognized method of managing wounds. In the developed world, commercially available patent devices like the Kinetic Concept Incorporated's VAC are being used (5). Such patent devices are equally available in the developing world but they are relatively expensive and not affordable for poor patients (1, 7). To reduce the cost, the different parts of the device have been replaced with locally sourced materials which are cheaper as observed in some studies (1, 4). In practical terms, certain situations may pose some difficulties in the application of negative pressure wound therapy. The difficult situations discussed by Lima et al (8) included the presence of an external fixator, anticoagulated patients, and sacral or excessively exudative wounds. In this report, however, the difficult situations discussed include the application of improvised negative pressure wound therapy in the setting of an external fixator and the application of NPWT with a complete cast and a window for wound dressing in situ.

Open fractures resulting from high-velocity injuries are increasingly being managed with external fixation devices to achieve good skeletal stabilization and to avoid the risk of infected implants (3). However, the use of NPWT in the setting of external fixators may affect the efficacy of the device; it may also increase the cost of the locally sourced materials and discourage its use (3). To circumvent this, some authors have suggested wrapping completely the external fixation device with a transparent drape [9]. Doing complete wrapping may make the procedure very expensive and even cumbersome; there is also an increased risk of drape puncture by the pins and wires (9). Some authors have also suggested placing hydrocolloid gel around the pins (10). Bulla et al (9) however made use of bone wax but this may not be readily available in some centers. Some authors have also complained that bone wax is not stable to thermal variations and tends to melt at body temperature (3). Other methods that have also been used include the use of skin adhesives and colostomy sealant paste, both have also been associated with one drawback or the other (3, 11). Despite all the adjunct measures mentioned, most authors still see air leakage as a major issue for trauma patients with external fixation pins in place. The simple use of opsite initially over the foam dressing and reinforcing it with cling film and subsequently wrapping strips of opsite around the pin sites and the potential leak sites as described in this report

is very effective and with lower cost when compared with other methods.

## Conclusion

The use of improvised negative pressure therapy is cost-effective in resource constraint settings because the materials can be locally sourced. The methods of its use in some difficult conditions with an external fixator in situ and over a complete below knee scotch cast with wound window have also been highlighted. Based on our finding, we recommend that cling film and opsite alone can be used in securing an airtight seal in negative pressure wound therapy set-up in difficult conditions because they are cheaper, locally sourced and yet effective.

### *Limitation of the study*

Because this is a case series, a prospective study will be required to further establish the findings.

### **List of abbreviations**

NPWT: Negative pressure wound therapy  
NG: Nasogastric  
USA: United States of America  
VAC: Vacuum-assisted closure

### **Declarations**

#### *Ethical consideration*

The need for ethical approval was waived by LAUTECH Teaching Hospital Ethical Review Committee

#### *Consent for publication*

Informed consent was obtained from the patients for publication of this case report and accompanying images.

#### *Availability of data and materials*

The data and materials used will be made available if needed

#### *Competing interest*

The authors declare that we have no competing interest

#### *Funding*

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#### *Authors' contributions*

IOS contributed to the conception, literature search, design of the work, and final write-up. AAA and AOF both contributed to the literature search, design of the work, and final write-up.

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