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Aggressive management of extensive de gloving injury of the left lower limb with debridement and split skin grafting and application of vacuum-assisted closure system over recipient grafting site in a tertiary health care setup

Anil Reddy[1], **Suhas Jajoo**[2], **Chandrashekhar Mahakalkar**[3], **Siddharth Mendiratta**[4], **Garima Saxena**[5], **Harshita J**[6]

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Authors' Affiliation:
[1]Jr Resident Department of General Surgery (3rd year), Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences, Sawangi, Wardha, Maharashtra, India
[2]Professor and Plastic surgeon, Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences, Sawangi, Wardha, Maharashtra, India
[3]Professor and Head of Unit Department of General Surgery, Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences, Sawangi, Wardha, Maharashtra, India
[4]Professor and Plastic surgeon, Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences, Sawangi, Wardha, Maharashtra, India
[5]Jr Resident Department of General Surgery, Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences, Sawangi, Wardha, Maharashtra, India
[6]Final MBBS student, Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences, Sawangi, Wardha, Maharashtra, India

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ABSTRACT

A novel technique for fixing skin grafts combines vacuum-assisted closure (VAC) with a dressing based on the bacterium Chlorhexidine gauze. In this instance, the patient came to us with substantial degloving damage to the left lower leg due to a crushing injury, with exposed femoral vessels and a knee capsule. He was on fluids and blood transfusions when we arrived. Emergency debridement was performed, the exposed vessels were covered with a sartorius flap, the exposed patella was covered with a gastrocnemius flap and both were then covered with a VAC dressing. Later, a serial meshed grafting was performed and each was covered with a VAC dressing. We, here aim to demonstrate that it is preferable to use VAC dressing over grafting for improved graft uptake and to reduce the need for frequent dressing changes in cases of pain and soakage. One week after dressing removal the rate of skin transplant acceptance was measured. In the same patient, the VAC dressing method is contrasted with traditional bolster dressing over the foot. Compared to the tie-over bolster technique the VAC plus chlorhexidine-based dressing region shows higher skin graft uptake rates and reduced levels of discomfort. There was graft loss over the foot where we used conventional dressing.

Keywords: Extensive degloving injury, Debridement, Split Skin Grafting, VAC dressing, Tie over dressing

1. INTRODUCTION

Skin grafts are frequently employed in patients with burns and trauma which cannot be repaired during reconstructive surgery (Langtry et al., 1998). For reconstruction to be effective, skin grafts must be fixed in the best possible way (Huang et al., 2007). The most frequently used immobilization method for securing the graft to the bed of the wound and ensuring appropriate postoperative graft adhesion is the traditional tie over bolster approach with splinting (Patton et al., 2013). However, this method has several drawbacks for both patients and medical professionals. Due to the tension created by bolster sutures and the pain experienced when the tie-over dressing is removed, patients may feel postoperative pain (Chou et al., 2019). In addition, it takes time and skill for doctors to place sutures around the perimeter to secure the graft to the wound bed (Gardner et al., 2017). The success of the graft can also be hampered by secondary trauma during removal brought on by the dressing's adhesion to the wound bed (Wong et al., 2017). Patients with open fractures and burn wounds have been given Vacuum Assisted Closure, often called negative pressure wound care, as a dressing to lessen the severity of the injury (Crnich et al., 2005). Utilizing VAC after surgery helps manage the environment, decreases exudation and promotes tissue granulation and local circulation. VAC can also be used for skin grafts as a dressing at the donor site, as a fixation method and as a bridge for grafting (Crnich et al., 2005). Due to its adequate fixation and lack of a splint, this approach has also improved patient mobility and saved physician's time. In addition, patients who employed VAC compared favorably to those who used standard dressings in postoperative pain and painkiller use. However, the tearing pain caused during dressing removal is still a problem.

For many years, there has been a need for primary wound contact material with non-adherent and non-traumatic characteristics, creating the ideal condition between the dressing and the wound bed. Silicon based wound dressings are said to be able to resolve the problems of pain and tissue adherence (Wonk et al., 2017). In addition, silicon-based dressings may help overcome the clinical drawbacks of VAC procedures for the fixation of transplant skin by lessening discomfort during dressing removal. Studies have shown that using VAC and a silicon-based dressing can decrease postoperative pain and pain caused during dressing removal compared to the traditional tie-over bolster approach for skin graft fixation (Wong et al., 2017).

Tie over

Using the bolster approach, the graft must cover the entire wound bed area without being stretched or wrinkled. Based on the surface of the wound bed, 3-0 or 4-0 nylon anchoring sutures were used first to stitch the graft. Each suture was spaced 4-10 mm apart. The duration of the procedure for attaching the graft to the wound bed is measured in seconds. Consequently, cotton balls wrapped in petroleum gauze were used. The sutures were then coated with petrolatum gauze and cotton balls with the help of a helper who held onto them to prevent spilling. Finally, the wound was bandaged and covered with a cotton roll. If the graft was placed at the extremities, a splint was put on and the time it took to do so was noted. The tie-over was taken off at the bedside four days following the procedure and the area was checked. Since it ensures contact between the graft and the wound bed, limiting hematoma buildup, this approach has been frequently employed for graft fixation.

VAC Treatment utilizing chlorhexidine gauge-based Dressing

After ensuring hemostasis, a graft was applied to the recipient area, either a mesh graft or a non-meshed graft. Graft fixation was accomplished using staples. Next, the graft was directly covered with a mesh sheet impregnated with chlorhexidine, followed by VAC dressing. Negative pressure is established according to the applied area and splits may need to be used if necessary. Following the procedure, we often check for graft take by opening the dressing at the bedside. Later, an alternate day dressing with Vaseline and a suitable compression dressing can be required.

2. CASE PRESENTATION

We present the case of a 34-year-old male, carpenter by occupation, who presented to the emergency department with a history of a road traffic accident (runover) that resulted in extensive degloving injury to the left lower limb with active bleeding from it (Figure 1). On arrival at casualty, his blood pressure was 80/50 mmHg and his pulse rate was 126 beats per minute. First, two wire bore needles were secured and intravenous fluids were given. Next, patient stabilization was done upon clinical examination. The left femoral vessels were exposed, the patella was exposed and the edges of the degloved skin did not show any active bleeding on the needle prick.

On radiological investigations, there was no long bone injury. However, there was a fracture of the medial malleolus of the left lower limb and the colordoppler showed good flow in both arterial and venous phases. All required blood investigations were

done, which showed hemoglobin of 6 gm%. Immediately, blood transfusion was started after cross matching and blood grouping. Once the patient was stabilized vitally, he was taken for emergency debridement of necrosed and degloved skin. A sartorius flap was done for the exposed femoral vessels and a medial gastrocnemius flap cover for the exposed left knee joint and VAC application after debridement was planned (Figure 2, 3).

Figure 1 Extensive degloving injury of left lower limb at the time of presentation

Figure 2 intraoperative photos after emergency debridement of non viable degloved skin

Wound culture shows no growth. During the postoperative period, hemoglobin was optimized again. He was retaken to the operation theatre on the 7 postoperative days and opened the VAC dressing. This time, further necrosis of the degloved skin was found. But during this time, a grant from the necrosed tissue was taken and placed over the left dorsum of the foot. A split skin graft was also taken from the opposite thigh and placed over the left knee where the gastrocnemius flap was made, left thigh and left leg and on the top graft, we applied VAC dressing.

Figure 3 intraoperative images showing medial gastrocnemius flap

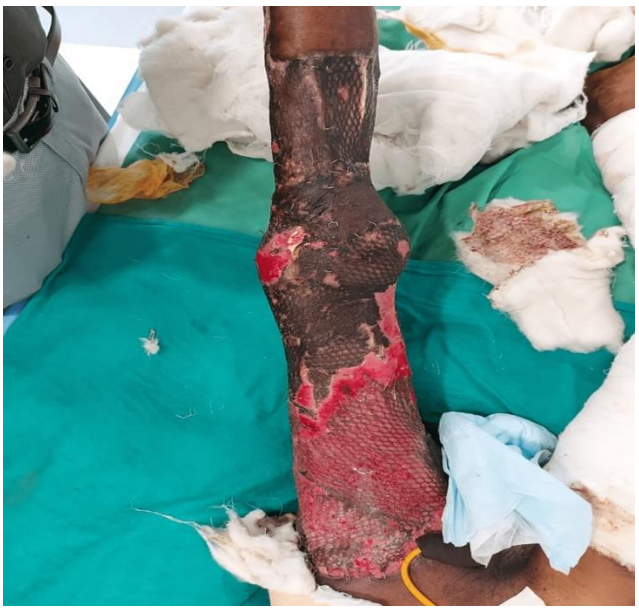

Figure 4 Dressing photo after the first stage of split skin grafting with VAC dressing

After 1 week, the VAC was opened again in the operation theatre and it was found to be a graft that had taken almost 90% this time (Figure 4). We harvested the graft from the right thigh and upper back, meshed it and placed it over the remaining raw area over the left thigh and the stapler was applied to the edge of the skin and graft. Again VAC was applied over the recipient area.

VAC was opened after 1 week on the bedside in the ward. It was found that graft take was good after that alternate day dressing with bactigras and physiotherapy was started slowly once the graft was settled. During his stay in the hospital, close monitoring of vitals and investigations were done, 5 units of blood were transfused and a high protein diet was given. Once the graft was settled, a crepe bandage applied was applied to the recipient site and dressing with betadine was done over the raw area on the thigh and foot. After 28 days from the admission time, with successful treatment in the form of debridement and grafting, the patient was discharged from the hospital with the advice of active physiotherapy and review in the surgery OPD. Figure 5 shows the complete uptake of the split skin graft with the use of VAC dressing over the split skin graft.

Figure 5 Follow up image showing complete uptake of split skin graft with the use of VAC dressing over the split skin graft

3. DISCUSSION

In a research based on the postoperative application of VAC to a mesh graft in chronic ulcers, it was discovered that the VAC treatment group's healing rate was much higher than that of traditional dressings (Korber et al., 2008). Compared to the conventional bolster dressing, investigations have shown using a VAC, even without a splint dressing, can provide a homogeneous compressive force to keep the graft in place. According to extensive sample research, split thickness skin grafts can be effectively secured using VAC. Also, they showed that VAC can be used in anatomically complex places, like the thighs, trunk and other curved parts of the body, where standard bolster dressings are difficult to apply. In a different study, VAC increased the SFSG rate by enhancing the revascularization process and reducing the buildup of seroma or exudate beneath the graft (which might impair adhesion) (Korber et al., 2008). With the help of a postoperative VAC, the researcher retrospectively examined 10 FTSG cases from the anterolateral thigh (ALT) and found that the thick skin of the FTSG had more tension than the STSG, causing uneven pressure on the wound bed and subgrant fluid accumulation; as a result, the use of VAC is practical for enhancing FTSG outcomes.

A study showed that VAC reduced operating time compared to the tie over bolster approach. However, VAC has several drawbacks, such as extra short-term medical expenses and adhesion during dressing removal. Compared to conventional bolster dressing, the large postoperative treatment length reduction can offset the rise in short term expenditures, which can lower overall long-term costs. However, damage to the graft tissue and suffering for the patient resulted from the adherence of sponge VAC dressing to the graft while removing it (Shin et al., 2017).

Because of the additional materials and application steps required, one of the technical drawbacks of the traditional tie over bolsters approach is a longer operative time (Chou et al., 2019). The use of polyurethane foam and elastic tapes is recommended over conventional continuous sutures and knots on bolsters to speed up surgery, eliminate medical waste and achieve good graft outcomes. A recent study showed that VAC outperformed the tie over bolster approach regarding skin graft survival and operating time due to the VAC system's simple application process and reduced installation time compared to the traditional tie over bolster technique. A single surgeon can also do VAC without the aid of assistance. Related research has shown that postoperative wound discomfort can cause psychological sadness, which can cause stress and delay wound healing. As a result, the clinical condition deteriorates even before wound care management is done adequately.

The psychological effects and symptoms of depression that are atypically sensed through the sensory pathway might be perceived as shameful or painful. To preserve the delicate, exposed tissue and lessen discomfort upon removal, Robert et al., (2016) evaluated the guidelines for VAC. They added a silicon interface between the wound and black foam of VAC. The key benefit of using a silicon-based dressing in addition to what was done in our study is that there is less pain when it is removed. Additionally, a pain assessment was performed to compare it to the traditional tie over bolster technique. In the current trial, the silicon-based dressing with VAC provided noticeably reduced tearing discomfort during dressing removal. This may be explained by the ability of silicon-based dressings to increase compliance by reducing general wound bed trauma. The VAC system is also simple to disassemble, depending on the clinician's experience and competency.

The silicon-based VAC plus dressing can also ensure that the graft stays in contact with the wound throughout the procedure. As a result, the graft's survival is improved, which raises the standard of postoperative wound care. Less postoperative discomfort, shorter recovery times and higher skin graft take rates are all benefits of using the VAC system with silicon-based dressing.

4. CONCLUSIONS

From this case, we come to the opinion that there should be a multidisciplinary approach for extensive degloving injury with loss of the majority of the skin of the involved part. First, we need to check if any vital structures are exposed. If yes, we first need to cover those structures as they are life saving. While debridement, it is essential to do serial excision of necrosed tissue by carefully observing the bleeding from the edges. As a precautionary measure, taking graft from the necrosed tissue is advisable. Meshed grafting may be considered as we must cover the extensive part of the degloved. On top of the graft, after placing bactigras, it is better to apply negative pressure vacuumassisted closure technique as it may help remove the excess fluid draining from the underlying muscles and other parts. With VAC dressing, there is no need for multiple dressings and frequent graft site openings. It reduces the chances of infection related to the frequent opening of dressings and pain is caused while removing the dressing. With a VAC, we can change the dressing once a week, supporting the extra fluid and making the graft settle faster than grafting with bolster dressing.

Informed consent

Written & Oral informed consent was obtained.

Authors' contributions

Anil Reddy has collected information and prepared the manuscript which has been thoroughly reviewed by Jajoo SN, Mahakalkar and Siddharth M. All the authors have read and agreed to the final manuscript.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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