e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2024; 16(3); 29-33

Original Research Article

Alternate Method of Inexpensive Customized Vacuum Assisted Closure Dressing for Infected and Non Healing Wounds

Ankesh Goyal[1], Abhishek Rathore[2], Vachan Goyal[3], Rohan Yadav[4]

[1]Associate Professor, Jaipur National University, Jaipur, Rajasthan
[2]Assistant Professor, Jaipur National University, Jaipur, Rajasthan
[3]Resident, Heritage Institute of Medical Sciences, Varanasi
[4]Senior Resident, Jaipur National University, Jaipur, Rajasthan

Received: 15-01-2024 Revised: 15-02-2024 / Accepted: 01-03-2024
Corresponding author: Dr. Rohan Yadav
Conflict of interest: Nil

Abstract

Background: Open fractures are very commonly encountered in orthopaedics. Type III open fractures proved the most difficult to treat owing to the varied injury patterns, increased morbidity from associated injuries, massive soft tissue damage or loss over the fracture sites, compromised vascularity, wound contamination, and fracture instability and sometimes require secondary procedures like grafting and flaps. Similar is the case with wounds that remain after debridement. These wounds especially over a subcutaneous bone like tibia take a long time to heal due to less availability to soft tissue to bridge the wound margins and presence of infection. Vacuum assisted closure (VAC) dressing is an effective way of treating these kind of wounds which are hard to heal and provide a faster way to heal the infection and provide healthy granulation tissue over which secondary procedure like skin grafting can be done. It reduces the time for wound healing. Conventional VAC dressing is costly and not everyone can afford it. Here we describe an inexpensive method for customised VAC dressing.

Methods: 48 patients were included in the study with various size and grade of wounds and treated with customised VAC dressing for various duration depending on the wound size.

Results: most of the wounds healed with the application of VAC dressing and could be closed with primary closure. 13 patients required split thickness skin grafting and 2 patients required flap for the closure of the wounds.

Conclusion: The customised VAC dressing was as effective as conventional VAC dressing in healing the wounds.

Keywords: Open fracture, Infected wounds, Vacuum assisted closure.

Introduction

Open fractures are very commonly encountered in orthopaedics.Type III open fractures proved the most difficult to treat owing to the varied injury patterns, increased morbidity from associated injuries, massive soft tissue damage or loss over the fracture sites, compromised vascularity, wound contamination, and fracture instability [1] and sometimes require secondary procedures like grafting and flaps. The most common reason for the delay in the treatment of open fractures is the wounds and complications like infections which take up lot of time to heal thus delaying the definitive treatment of fracture. Similar is the case with wounds that remain after debridement. The normal protocol followed in the treatment of these types of wounds is debridement and early stabilisation of bone through external fixators along with proper coverage of antibiotics. The definitive management in these cases is internal fixation which has to be postponed till the wound has healed and the skin condition is good with no discharge. Conventional dressings take a long time to heal the wounds and thus delay the definitive management.

Vacuum assisted closure dressing can be used instead of conventional dressing to speed up the healing of wounds and to reduce the infection. Negative pressure applied in VAC dressing stabilizes the wound environment, reduces wound edema/bacterial load, improves tissue perfusion, and stimulates granulation tissue and angiogenesis. All this improves the possibility of primary closure of wounds and reduce the need for plastic procedures. [2]

Conventional VAC dressing is costly and thus cannot be afforded by patient of lower socioeconomic status. In our hospital we used an alternative method of inexpensive customized VAC dressing for infected and non-healing wounds with results similar to that of conventional VAC dressing.

Materials and Methods

This is a retrospective study conducted in our hospital between December 2020 to December 2022. 48 patients were included in this study whose data was collected from the records and for whom customised VAC dressing was applied along with standard care. All the cases had non healing wounds. Out of the 48 patients, 35 cases were of open fracture tibia and 13 cases were open fracture femur. All the open fractures were of Gustilo and Anderson type II, IIIA or IIIB.

Materials needed for customised VAC dressing – IOBAN (Fig. 1a), sterile sponge (Fig. 1b), ryle's tube(Fig. 1c) and suction apparatus(Fig. 1d). The suction apparatus was used to provide negativepressure in the VAC dressing and had a meter to show the amount of pressure applied and a knob to regulate the pressure. The negative pressure was applied intermittently for a period of 15-20 minutes followed by no pressure for 40-45 minutes as continuous pressure often leads to pain around the wound and also to prevent the suction machine from overheating.

Figure 1: Materials needed for customised VAC application a. IOBAN b. sponge c. Ryle's tube d. vacuum suction machine

Method of application of customised VAC

1. The wound was debrided and cleaned thoroughly before the application of VAC dressing.

2. Sterile sponge was cut in appropriate wound size so as not to cover the surrounding normal skin as long standing pressure on the normal skin can lead to skin maceration.
3. Ryle's tube is taken and cut to appropriate size so that it covers atleast half the length of the sponge and no holes are outside the sponge. Additional holes are made in the ryles tube if the length of the tube is cut too short.
4. A tunnel is made in the sponge using scissors which goes till atleast half the length of the sponge and ryles tube is inserted in that tunnel.
5. The sponge is then placed over the wound and positioned so that it covers all the margins of the wound.
6. The sponge is fixed in place using IOBAN covering a part of the surrounding normal skin to properly anchor the sponge to the wound.(Fig.2a)
7. The ryles tube coming out of the sponge is secured at the entry using ioban so that there is no leakage.
8. The end of the ryle's tube is connected to the suction apparatus and the connection is secured with IOBAN so that there is no leakage.(Fig.2b)
9. Suction apparatus is switched on to check for any signs of leakage. If leakage of pressure if found from any site then it is fixed using IOBAN.
10. Compression of the foam with wrinklingon the surface of foam and IOBAN suggests that there is no leakage and that negative pressure is applied on the wound.
11. The desired pressure is set using the knob on the suction apparatus

a. b.

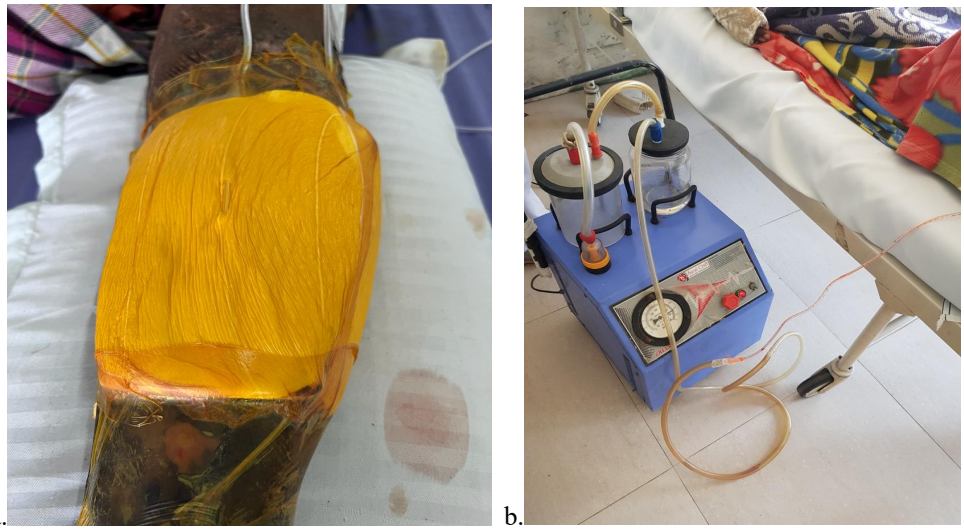

Figure 2: (a).VAC dressing fixed using IOBAN; (b). Ryle's tube connected to vacuum suction machine

VAC dressing was changed every 2-3 days depending of the contamination of the sponge.

Mechanism of action - VAC causes increased tissue pressure which leads to compression of vessels and increased velocity of the intravascular fluid which reduces the intravascular hydrostatic pressure. Both the factors cause less efflux of intravascular fluid and decreased edema. In addition the compressive forces of VAC dressing physically force edema away from the injured tissues. Microdeformation/ microstrain of cells due to VAC causes tissue expansion effect with release of growth factors. The pressure within the cells is positive; while the pressure outside the cells and beneath the dressing is negative. This may lead to expansion of cells, growth of granulation tissue and pulling of wound edges closer to one another reducing wound size. [2]

Results

Total 48 patients were included in the study out of which 35 cases were of open fracture tibia and 13 cases were open fracture femur. 36 out of the 48 patients were male and 12 were female. Mean age of the study group was 38 years (12-50 years)

Table 1: Patient details

	No. of patients
Male	36
Female	12
Open fracture tibia	35
Open fracture femur	13
Mean age in years (range: 12-50 years)	38 years

The number of VAC dressings done were

Table 2: No. of VAC dressing done per patient

No. of VAC dressings	Patients
1	3
4-6	39
7-9	6

After the healing of wounds most of the wounds could be closed with primary closure(Fig.3). 13 patients required split thickness skin grafting (Fig.4) and 2 patients required flap. Primary closure was done at the time of definitive management. 10 out of 13 patients with femur fracture were treated with intramedullary interlocking nail, 2 were treated with minimally invasive distal femoral plating and 1 was treated with ilizarov ring fixator. 24 out of 35 patients with tibia fractures were treated with intramedullary interlocking nail, 3 were treated with tibial plating and 8 were treated with ilizarov ring fixator.

Bone involved	Definitive fixation method	Mode of wound closure	Follow up
Femur (n=13)	Intramedullary interlocking nail (n=10) Minimally invasive distal femoral plating (n=2) Ilizarov ring fixator (n=1)	Primary wound closure (n = 8) Split thickness skin grafting (n = 5)	Union (n = 10) Non-union (n = 2) Infected non-union (n = 1)
Tibia (n=35)	Intramedullary interlocking nail (n=24) Tibial plating (n=3) Ilizarov ring fixator (n=8)	Primary wound closure (n = 25) Flap (n = 2) Split thickness skin grafting (n = 8)	Union (n = 30) Non-union (n = 3) Infected non-union (n = 2)

Figure 3: a.Initial condition of wound B. VAC applied C. Final condition of wound after multiple VAC dressings

Figure 4 a.Initial wound condition b.After debridement and 1st VAC dressing c.After multiple VAC dressings d.Split skin grafting done

Discussion

Treatment of open fractures still proves to be challenging because of associated injuries and high chances of infection. Proper and early debridement, proper antibiotic coverage and early stabilisation of fractures is very important and helpful in managing the fracture and reducing complications. The most common reason for chronic and infected wound is improper and inadequate debridement followed by closure done at the peripheral centres in villages due to unavailability of proper facilities. Patient generally presents to a hospital late when the wound is already infected. Most of the patients are from poor backgrounds and of lower socio-economic status and cannot afford proper treatment.

Conventional dressing takes a very long time to heal these kinds of wound. VAC dressing is an alternative method for treating these type of wounds and has proven to be effective in early healing of these wounds and also helps to reduce infection thus reducing morbidity. It works by applying negative pressure at the wound site which decreases oedema, increased formation of granulation tissue, promotes angiogenesis and also promotes collagen formation. The high vascular environment created by VAC therapy increases oxygen delivery and immune cells in the wound which prevents bacterial proliferation. [3,4,5,6] All this leads to faster wound healing and less need of secondary procedures for coverage of wound.

Conventional VAC dressing is costly and thus cannot be afforded by people of lower socio-economic status. Our alternate method of inexpensive customized vacuum assisted closure dressing is similar in efficacy to the conventional VAC dressing and is also cheap thus can be afforded by poor patients. The wound size reduced after application of VAC dressing, there was faster healing of infection and less need for secondary procedures for wound healing. Thus it is useful in 7. treatment of wounds and in reducing infection especially in the cases of open and compound fractures.

Conclusion

The customised VAC dressing was as effective as conventional VAC dressing in healing the wounds

Conflict of interest: On behalf of all authors, the corresponding author states that there is no conflict of interest.

References

1. Kim PH, Leopold SS. Gustilo-Anderson classification.
2. Agarwal P, Kukrele R, Sharma D. Vacuum assisted closure (VAC)/negative pressure wound therapy (NPWT) for difficult wounds: A review. Journal of clinical orthopaedics and trauma. 2019 Sep 1;10(5):845-8.
3. 3.Bhat TA, Ibrahim R, Bhat TA, Bhat AA. In-hospital low-cost custom made VAC: Effective method for reducing infection in late presenting Open lower limb fractures in overburdened Indian hospitals. Journal of Clinical Orthopaedics and Trauma. 2019 Jan 1;10(1):195-200.
4. Mouës CM, Vos MC, Van Den Bemd GJ, Stijnen T, Hovius SE. Bacterial load in relation to vacuum-assisted closure wound therapy: a prospective randomized trial. Wound repair and regeneration. 2004 Jan;12(1):11-7.
5. Orgill DP, Manders EK, Sumpio BE, Lee RC, Attinger CE, Gurtner GC, Ehrlich HP. The mechanisms of action of vacuum assisted closure: more to learn. Surgery. 2009 Jul 1;146 (1):40-51.
6. Scherer SS, Pietramaggiori G, Mathews JC, Prsa MJ, Huang S, Orgill DP. The mechanism of action of the vacuum-assisted closure device. Plastic and reconstructive surgery. 20 08 Sep 1;122(3):786-97.