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Vacuum-assisted closure combined with a closed suction irrigation system for treating post-traumatic raw area

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Abstract
Background: Post traumatic raw area is a very troublesome condition to treat which requires long term regular dressings, higher antibiotics and close monitoring of patient vitals. This study evaluates the efficacy of modified Vacuum-assisted closure (VAC) combined with a closed suction irrigation system for treating an post-traumatic wound and infection.
Methods: We conducted a retrospective study of 20 patients with post-traumatic raw areas from 2020 to 2021 at a single tertiary center. All patients included in the study received modified VAC treatment (VAC combined with a closed suction irrigation system, CSIS) until the wound can be closed secondarily. Detailed information was obtained from the medical records.
Results: Reduction in wound size was significant after 1 week of VAC with CSIS treatment. The patients had excellent wound beds after an average of 3 -6 days(1 or 2 cycles of VAC with CSIS) All wounds healed completely and were infection free after an average of 15 days, and the average hospital stay was 22 days. Wounds remained infection free after coverage.
Conclusions: This study shows that VAC combined with a CSIS is a superior method to treat raw areas compared to conventional VAC. This improved VAC procedure provides an excellent granulation to facilitate wound healing, hasten closure and shorten the hospital stay.

Keywords: post-traumatic wound, open fractures, VAC, debridement, wound healing, CSIS, wound care

Introduction

Patients

This was a single-group retrospective study carried out in the orthopedics department at a single tertiary center. All patients gave informed consent prior to the study, which was approved by the Institutional Review Committee of our hospital.
All patients with a post-traumatic raw area, post-operative infection wound gaping and bedsore between April 2020 and May 2021 were included in this study. Patients with polytrauma, head injury and malnutrition were excluded. Thus, 14 males and 6 females (age range 18–60 years; mean age, 36 years) were included in this study. The preoperative diagnoses were limb extremity trauma and post-operative guillotine amputation stumps. All patients were treated with intravenous prophylactic antibiotics after the initial treatment and later switched to antibiotics according to swab culture and sensitivity as directed by infectious disease expert.

A post-traumatic wound/raw area was defined as

1. positive wound bacteria culture results
2. Wound with complete loss of skin but without bone exposure.

Patients with exposed bone were excluded because such patients generally require flap surgery and soft tissue cover by granulation tissue is difficult to achieve in them via VAC or other traditional form of dressing. A piece of polyurethane foam was cut according to size and shape of the wound and placed. We used two tubes, one for suction which maintained continuous negative pressure and created vacuum, the second tube was used to irrigate the wound with

antibiotics and saline. Transparent cling drape or similar waterproof film is used to cover the foam ensuring no leakage which maintains vacuum. A large volume of normal saline was injected into the wound through the flushing tube and exited through the exudate or necrotic tissue. The suction machine aimed for negative pressure (125 mmHg) for at least 3 days. For irrigation fluid, 2000 to 3000 ml of saline was used with antibiotics according to culture and sensitivity reports and replaced once daily. The wound secretions collected during debridement were cultured, and antibiotics were selected according to drug sensitivity test results. According to our experience in our center most bacteria isolated from the wound are sensitive against vancomycin so We started with vancomycin in all as empirical antibiotic if specific culture sensitivity report was unavailable or pending, Vancomycin was replaced when specific antibiotic according to culture and sensitivity report. Once the bacterial culture results were available, the treatment lasted for at least 2 cycles of modified VAC.

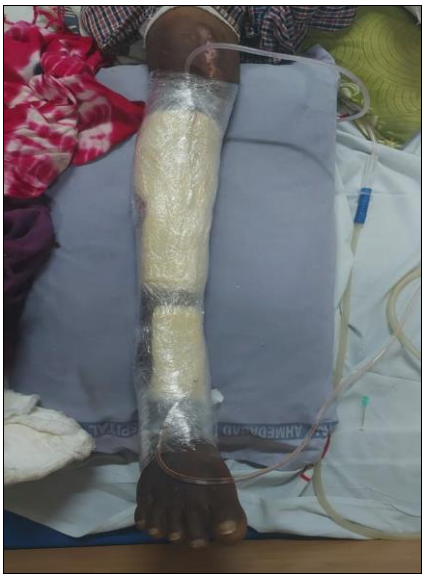

Fig 1: Suction irrigation vac applied for raw area on left

Treatment protocol

Patients with post traumatic raw areas were treated traditionally during the early stage confirming haemostasis, saline dressing was changed twice or more per day according to the wound exudate status. Any drugs or materials which promote wound healing were not used. All patients underwent extensive debridement under anesthesia after which all received the modified VAC treatment. In debridement all slough, necrotic and infected tissue was removed and wound margin was freshened.

We evaluated wound healing time, reduction in wound size, microorganism type, time taken for wound to become infection free, decrease in total wbc count, ESR, CRP, hospital stay. The other outcome measures were granulation tissue quality, pain and discomfort, and patient expenditure. Healing time of wound was the interval between the first debridement and complete wound closure. Wound healing was defined as closure of the wound, without gaping, and with complete epithelium coverage or coverage by split thickness graft or significant reduction in size of wound which allows discharge of patient on regular self-dressing at home allowing healing by secondary intention.

Discussion

Among the various drugs, enzymes, materials, and devices used to treat wound infections, Vacuum-assisted closure (VAC) is a relatively new method of wound care. In recent times there is quick adaptation of VAC for treatment of raw area. but the protocol of use of VAC varies markedly among human body parts. In our institute VAC is mainly used to treat extensive lower extremity trauma with soft tissue defects and wound infections where rapid growth of healthy granulation tissue is required. Dressing techniques such as dressing with saline, EUSOL, hydrogen peroxide solutions, silver based compounds, collagen granules have been used on raw areas for many years, but these tend to make patients very uncomfortable because of pain, foul smell, high cost, and prolonged hospital stay. In government settings such as ours, costly instruments for VAC therapy are out of patient reach These conditions have led to the development of a convenient, effective, and economic wound care method in which negative pressure is exerted on the wound after debridement. VAC involves the use of a polyurethane foam dressing, a transparent semi-permeable film, and a drain tube connected to a negative pressure bottle or a computer-controlled negative pressure pump. We replaced costly VAC machines with simple suction machines which are readily available in any ward or operation theater. In place of the costly computer-controlled negative pressure pump the simple suction machine serves the purpose but they have to be controlled manually. The advantage of modified VAC treatment is constant presence of antibiotic at local site with continues removal of the secretion between the tissue spaces which reduces edema, prevents accumulation of bacteria in the wound, increases blood flow perfusion by stimulating granulation and proliferation. It rapidly provides favourable conditions for flap transplantation, STG placement or secondary wound closure.

Ten patients were treated with new continuous negative pressure and irrigation for post-traumatic with excellent outcomes. In this study, we retrospectively evaluated the efficacy of a modified VAC device (VAC combined with CSIS) to treat post-traumatic raw area, post-operative infection wound gaping and bedsore.

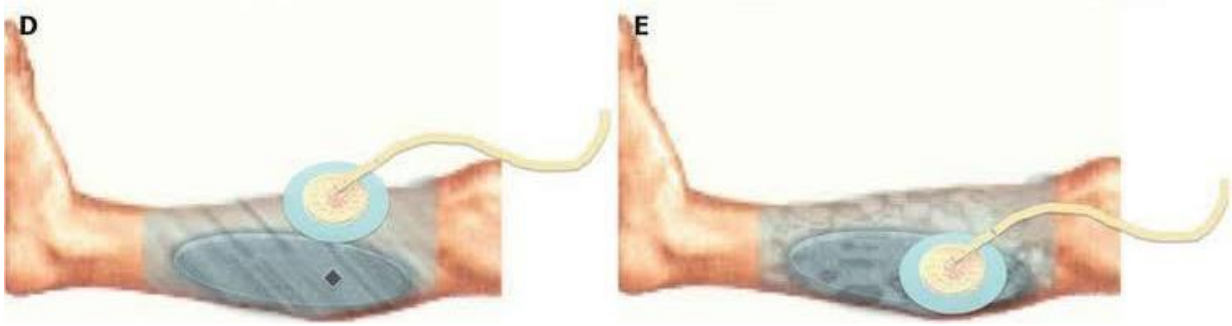

Fig 2: Steps of application of vac

Results

Twenty patients were included in the study; Table 1 shows their demographic characteristics. A laboratory examination revealed increased C-reactive protein (CRP) in 15 (75%) patients, an increase in the erythrocyte sedimentation rate (ESR) in 16 (80%) patients, and leukocytosis in 8 (40%) patients. there were no complications

Table 1: Results

Characteristics	VAC (n=20)
Average age (years)	52
Male sex	14
Female sex	6
Total number of VAC cycles	
Two	15
Three	4
Four	1
Organisms isolated in culture:	
None	3
Staphylococcus aureus	6
Acinitobacteriae	4
Pseudomonas	3
E. Coli	1
Enterobacterie	1
Antibiotic used in irrigation:	
Vancomycin	14
Ceftriaxone	3
Piptaz	2
Meropenem	2
Individual parameters:	
Age >65	5
Hypertension	4
Diabetes	4
Smoking	1
Clinical parameters:	
Fever	7
Discharge	18
Laboratory parameters:	
CRP >10 mg/L	15
ESR >20mm per hr	16
WBC > 10 x 10^9 cells/ml	8

All patients were treated with prophylactic antibiotics before starting treatment. After the wound sampling, the antibiotics were changed according to the drug sensitivity test results. We obtained the wound change parameters from the medical records after 3-6 days of VAC treatment. The results show that the size of the wound after treatment with modified VAC was significantly smaller than that after debridement ($p < 0.05$).The average wound size was reduced from 23.5 to 13.2 cm2.The total cost of the VAC dressing was significantly higher than that of a traditional dressing, but the time cost for clinicians and nursing staff was significantly lower for the VAC treatment than for the traditional dressing treatment. An excellent wound bed was achieved in all patients after an average of 8 days of VAC treatment. The patients were sent to the operating room to close the wound under anesthesia. Four patients were treated with VAC three times and one patient received VAC treatment four times, while the remainder received two VAC treatments. The average wound healing time and hospital stay of patients treated with modified VAC was 17 and 25 days respectively. Wound secretions from 18 patients were cultured after debridement: there were six patients with Staphylococcus aureus, 4 with Acinitobacteriae, 3 with Pseudomonas aeruginosa, 1 with *E. coli* and 1 with Enterobacter aerogenes; 3 patients had no bacteria in the wound. All patients were followed-up for at least 1 year, and none of the patients developed a recurrent infection.

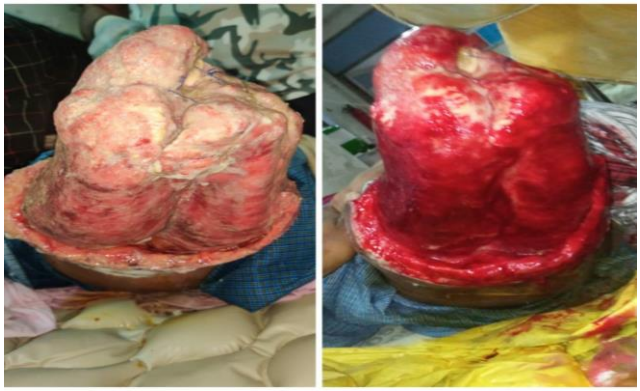

Fig 3: Granulation tissue formation post multiple vac applications on amputation stump

Fig 4: Granulation tissue formation on post traumatic raw area on heel after multiple vac applications

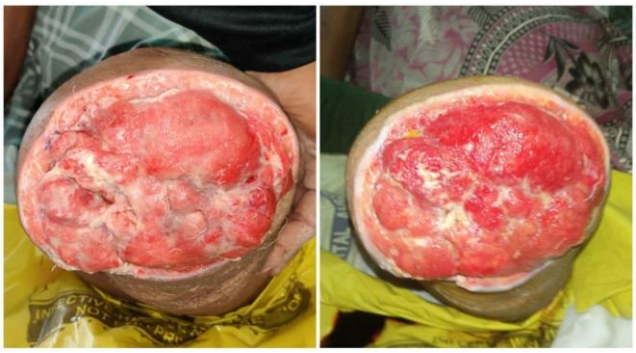

Fig 5: Granulation tissue formation on guillotine amputation stump post multiple vac applications

Conclusion

VAC combined with a CSIS is a safe, reliable, and effective method for treating post-traumatic wound/raw area. The improved VAC system used in this study maintained an excellent wound bed and avoided the need for frequent dressing changes. Therefore, the improved VAC device is a good method for treating post-traumatic wound/raw area. Therefore it could replace traditional dressings as the optimum treatment for post-traumatic wound/raw areas.

References

1. Argenta LC, Morykwas MJ. Vacuum-assisted closure: a new method for Wound control and treatment: clinical experience. Ann Plast Surg 1997;38(6):563-76.
2. Eginton MT, Brown KR, Seabrook GR, Towne JB, Cambria RA. A prospective Randomized evaluation of negative-pressure wound dressings for diabetic Foot wounds. Ann Vasc Surg 2003;17(6):645
3. Zannis J, Angobaldo J, Marks M, DeFranzo A, David L, Molnar J *et al*. Comparison of fasciotomy wound closures using traditional dressing Changes and the vacuum-assisted closure device. Ann Plast Surg 2009;62(4):407-9. https://doi.org/10.1097/SAP.0b013e3181881b29.
4. Wild T, Stremitzer S, Budzanowski A, Hoelzenbein T, Ludwig C, Ohrenberger G. Definition of efficiency in vacuum therapy-a randomised controlled trial Comparing with V.A.C. Therapy. Int Wound J 2008;5(5):641-7. https://doi.org/10.1111/j.1742-481X.2007.00407.x.
5. Braakenburg A, Obdeijn MC, Feitz R, van Rooij IA, van Griethuysen AJ, Klinkenbijl JH. The clinical efficacy and cost effectiveness of the vacuum assisted closure technique in the management of acute and chronic Wounds: a randomized controlled trial. Plast Reconstr Surg 2006;118(2):390- https://doi.org/10.1097/01.prs.0000227675.63744.af.
6. Kanakaris NK, Thanasas C, Keramaris N, Kontakis G, Granick MS, Giannoudis PV. The efficacy of negative pressure wound therapy in the management of Lower extremity trauma: review of clinical evidence. Injury. 2007;38:S9–https://doi.org/10.1016/j.injury.2007.10.029.
7. Kiyokawa K, Takahashi N, Rikimaru H, Yamauchi T, Inoue Y. New continuous Negative-pressure and irrigation treatment for infected wounds and Intractable ulcers. Plast Reconstr Surg 2007;120(5):1257-65. https://doi.org/1097/01.prs.0000279332.27374.69.
8. Deva AK, Buckland GH, Fisher E, Liew SC, Merten S, McGlynn M, *et al*. Topical negative pressure in wound management. Med J Aust 2000;173(3):128-31.