



ROLE OF LOW COST CUSTOM MADE VACUUM ASSISTED CLOSURE (VAC THERAPY) IN ORTHOPAEDIC WOUNDS

Orthopaedics

Dr. Umer Mehraj PG Scholar, Department of orthopaedics, Govt. Medical College Srinagar.

Dr. Shahan Malik PG Scholar, Department of orthopaedics, Govt. Medical College Srinagar.

Dr. Azad Ahmad Shah Assistant Professor, Department of orthopaedics, Govt. Medical College Srinagar.

Dr. Wasif Kawsar Qadri* PG Scholar, Department of orthopaedics, Govt. Medical College Srinagar.
*Corresponding Author

Dr. Tajamul Gulshan PG Scholar, Department of orthopaedics, Govt. Medical College Srinagar.

Dr. Ishtiyag Lone PG Scholar, Department of orthopaedics, Govt. Medical College Srinagar.

ABSTRACT

Introduction: Management of open fractures and massive soft tissue injuries require multi-disciplinary approach. VAC therapy is an innovative approach to the treatment of these wounds, facilitates granulation tissue formation, promotes healing, reduces infection and allows early skin grafting or flap closure. The aim of this work was to evaluate the role of low cost custom made VAC therapy in orthopaedic wounds. **Materials And Methods:** In this study a total of 23 consecutive patients were enrolled. Initial assessment of all the wounds was done and VAC therapy was used as adjuvant to debridement in wound care. **Results:** We have found rapid progress in the wounds with respect to decrease in the oedema, formation of granulation tissue and reduction in the size of wound. We were able to cover wounds earlier. The mean reduction of 61 % was seen in wound size by end of VAC therapy. Mean wound grade before VAC therapy was 3.1, which decrease by 1 grade. **Conclusion:** VAC therapy proves to be safe and effective treatment modality for soft tissue injuries.

KEYWORDS

Vacuum assisted closure, (VAC), Negative pressure wound therapy, (NPWT), Difficult wounds, Sub-atmospheric pressure dressing

INTRODUCTION

Patients with severe orthopaedic trauma with open fractures and massive soft tissue damage pose a demanding clinical challenge. Management requires multi-disciplinary approach, orthopedic, vascular and plastic-reconstructive procedures. Acute and chronic wounds contribute a major share in orthopaedically ill patients. High energy fractures are increasing in numbers and these requires both soft tissue and bony stability. In these types of injuries, treatment involves thorough and meticulous debridement. This results in tissue defects which precludes primary closures, delayed primary closures, secondary closures or healing by secondary intentions. This usually requires lengthy hospital stays and expert nursing home care which is not always possible.

Wound healing is a complex process which includes removal of dead tissues, control of bacterial load, control of inflammation, increased blood flow, formation of granulation tissue, contracture, remodeling of connective tissue matrix and finally maturation [1]. VAC therapy is an innovative approach to the treatment of serious, complex wounds through the use of sub-atmospheric or negative pressure known as "negative pressure wound therapy" (NPWT). NPWT is being used to treat many of these wounds with the hope of reducing infection and promoting healing, sufficient to allow skin grafting or flap closure. 1,2,3 Negative pressure wound therapy (NPWT), whose most widely used variant is Vacuum Assisted Closure (VAC), was introduced in North America in 1997 by Argenta and Morykwas [1,2]. Subatmo-spheric pressure is applied to the surface of a wound that is sealed off by a film dressing and connected via a tube to a suction pump and drainage collection system. NPWT is gaining in popularity as a method that diminishes the number of dressing changes, can be applied readily at the bedside, and is generally believed to shorten the duration of wound care. The most important benefits of this therapy include, a reduction in the wound area together with induction of new granulation tissue formation, effective wound cleansing (removal of small tissue by suction), and the continuous removal of wound exudates. It is very cheap compared to conventional VAC therapy and materials can be made easily available.

MATERIALS AND METHODS

This prospective study was conducted in Govt. Bone and Joints Hospital, Barzulla an associated hospital of Govt. Medical College, Srinagar from January 2022 to December 2022. In this study a total of

23 consecutive patients were enrolled.

Inclusion Criteria:

1. Chronic ulcers
2. Open fractures
3. Post traumatic large wounds with defect and pressure sores

Exclusion Criteria:

1. Wounds with bony infection
2. Bleeding wounds
3. Malignancy
4. Patients with allergy to adhesive dressings
5. Wounds with exposed neurovasculature

VAC Therapy:

Initial assessment of all the wounds was done. After thorough debridement, vacuum assisted closure of wounds was done. A single layer of wet gauze was applied over the debrided wound. Sterile foam was cut just larger than the size of bed of wound. Sponge was cut horizontally in two parts partially and Ryle's tube was put in between the layers of sponge through a slot. Sponge was secured in an airtight environment over the wound with the help of sterile surgical adhesive dressing. The other end of Ryle's tube was connected to wall mounted central suction tubings. Negative pressure is set to in between 120-150 mm of Hg. Negative pressure was applied for a period of 57 minutes every hourly for 4 days. The materials that were used for the VAC therapy were easily available in the hospital.

RESULTS

The average age of the study population was 41.30 (range 23-67) years. There were 14 (60.87 %) males and 9 (39.13 %) females in this study. The common mechanism of injury was road traffic accidents in 16 (69.57 %) followed by work spot injury in 5 (21.74 %) patients (Table 1).

Table 1: Demographic characters of study population (N=26)

Demographic characters		No. of patients	Percentage
Sex	Male	14	60.87
	Female	09	39.13
Age group	18-40 Years	12	52.17
	41-60 Years	07	30.43
	>60 Years	04	17.39

Mechanism of injury	Road traffic accidents	16	69.57
	Work spot injury	05	21.74
	Fall from height	02	08.69
Side	Right	15	65.22
	Left	08	34.78

We have found rapid progress in the wounds with respect to decrease in the oedema, formation of granulation tissue and reduction in the size of wound. We were able to cover wounds earlier.

In this study, average VAC dressing applied was 5.9 (range 4-10) days. The number of VAC dressings required for wound closure was 4 days in 7 (30.43 %) patients, 6 days in 6 (26.09 %) patients, 8 days in 5 (21.74%) patients and 10 days in 5 (21.74 %) patients. The mean reduction of 61 % was seen in wound size by end of VAC therapy. Mean wound grade before VAC therapy was 3.1, which decrease by 1 grade. Complications like infection, bleeding and skin irritation were not seen in our study.

In this study wound healing was excellent in 16 (69.57 %) patients, good in 7 (30.43 %) patients.



Figure 1: A 28 year old female patient with infected HTO. A (Pre VAC), B (VAC applied) and C (Post VAC)

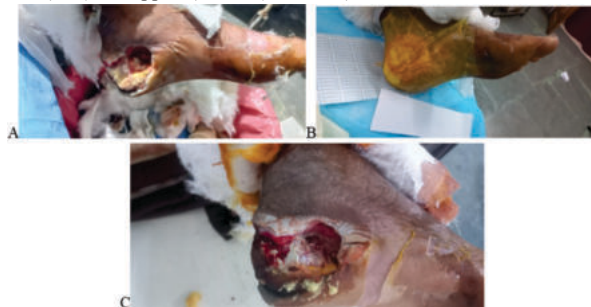


Figure 2: A 42 year old male patient with compound fracture calcaneum. A (Pre VAC), B (VAC applied) and C (Post VAC)



Figure 3: A 36 year old male patient with infected non-union tibia. A (Pre VAC), B (VAC applied) and C (Post VAC)

DISCUSSION

In orthopaedics, the wound healing and surgical site infection is a disaster for both the patient and the surgeon, typically following hardware implantation. This leads to prolonged hospital stay, increased use of antibiotics, repeated debridement's, prolonged rehabilitation and may results in morbidity and mortality [7, 8]. Wound healing is a complex process taking place in several phases: hemostasis, inflammatory phase, proliferation and consolidation of a new tissue. In spite of many general, some local factors influence wound healing like wound location, surface and depth of the wound, blood supply within the extremity and the presence of invasive infection.

The management of the wound is an interdisciplinary issue and as with each interdisciplinary issue the responsibility for wound therapy is spread. Patient with acute traumatic wound can be managed at intensive care unit, general surgery or orthopedic department. Extensive traumatic and chronic wounds state a real problem and challenge at an orthopedic department as many specialists have skills focused on fracture therapy or implantation of artificial joints. Situation when an ideal patient with fracture, but without any comorbidity is hospitalized in orthopedic department is rather a rarity.

Conventional treatment method is plastic surgery after the formation of granulation tissue by wet dressing. 12 Frequent wet dressing is required which will be painful and protracted. It is difficult to form healthy granulation tissue over tendon, bone or implants which often require surgical exercise like free flap surgeries. Free flap surgeries have their own drawbacks and morbidities.13

VAC therapy is an increasingly popular method to promote wound healing in orthopaedic surgeries. VAC or Negative pressure wound therapy has been used successfully to help prepare wound beds for rapid definitive wound closure procedures. The mechanism of action of VAC therapy is to create negative uniform sub atmospheric environment, thereby, reducing tissue oedema, promoting angiogenesis, improving vascularity and oxygen supply, formation of granulation tissue and contracture of size of wound [5,6,7]. VAC therapy have been extensively used in wounds of mixed aetiologies such as laparotomy wounds, extremity ulcers and spinal wounds [11, 12]. Some of these techniques are now being explored in orthopaedic wounds as an adjunct to antibiotic therapy and surgical debridement in implant salvage procedures. As the results were so encouraging, its application in the management of wounds was rapidly increased. Present, VAC therapy is used on almost every wounds [13].

Compound injuries with large defects have high chances for delayed and non-union. Early coverage of bones, tendons and neurovascular structures is crucial for better results. VAC therapy help reduce the time between initial debridement and definitive procedure to cover the wound. Also, the biggest advantage of VAC therapy is reduced number of dressings required compared to conventional dressing therapy. It also has reduced financial burden. We were able to do early definitive fixation for bony injuries in these patients.

Many studies on different wounds suggests that VAC may be more economical as compare to conventional wound care methods as it requires fewer dressing changes and lesser reconstructive options for wound healing. Wound healing is faster and overall short duration of treatment and hospitalization. The economic aspects of VAC therapy has been also assessed and it was shown by Birke-Sorensen that compared with conventional therapy, VAC therapy reduces costs of wound therapy through combination of better outcomes and reduced use of nursing resources [14]. In our series, we have used the material that is easily available in our hospital. Also, we have used readily installed central suction bedside units in our hospital for suction purpose. This way we were able to achieve better results effectively and efficiently while cutting the cost of treatment at the same time.

CONCLUSION

VAC therapy proves to be safe and effective treatment modality for soft tissue injuries. It accelerates the wound healing by lowering the bacterial count and increasing the rate of granulation tissue formation. It reduces the duration of treatment and hospital stay which indirectly reduce the expenses of treatment. It also remarkably reduces the need of extensive plastic surgery.

REFERENCES

- Weinstein MA, McCabe JP, Cammisia FP. Postoperative spinal wound infection: a review of 2,391 consecutive index procedures. *J Spinal Disord.* 2000;13(5):422-426.
- Cipolla J, Baillie DR, Steinberg SM et al. Negative pressure wound therapy: unusual and innovative applications. *OPUS* 12. *Scientist* 2008;2(3):15-29.
- Mouës CM, Heule F, Hovius SE. A review of topical negative pressure therapy in wound healing: sufficient evidence?. *Am J Surg.* 2011, 201:544-556.
- Scholl L, Chang E, Reitz B, Chang J. Sternal osteomyelitis: use of vacuum-assisted closure device as an adjunct to definitive closure with sternectomy and muscle flap reconstruction. *J Card Surg.* 2004;19(5):453-461.
- Cothren CC, Moore EE, Johnson JL, Moore JB, Burch JM. One hundred percent fascial approximation with sequential abdominal closure of the open abdomen. *Am J Surg.* 2006;192(2):238-242.
- Somanchi BV, Khan S: Vacuum-assisted wound closure (VAC) with simultaneous bone transport in the leg: a technical note. *Acta Orthop Belg.* 2008, 74:538-541.
- Erba P et al. Angiogenesis in wound treated by micro deformational wound therapy. *Ann Surg* 2011;253(2):402-409.
- Brandi C, Grimaldi L, Nisi G et al. Treatment with vacuum-assisted closure and cryopreserved homologous de-epidermalised dermis of complex traumas to the lower limbs

- with loss of substance, bones and tendons exposure. *Jplast Reconstr Anesthet Surg* 2008;61(12):1507-11.
9. Argenta LC, Morykwas MJ (1997) Vacuum-assisted closure: a new method for wound control and treatment: clinical experience. *Ann Plast Surg* 38(6):563-577
 10. Robert N (2017) Negative pressure wound therapy in orthopaedic surgery. *Orthop Traumatol Surg Res* 103(1):S99-103.
 11. Giri P, Krishnaraj B, Chandra Sistla S, Sistla S, Basu D, Shankar G et al (2021) Does negative pressure wound therapy with saline instillation improve wound healing compared to conventional negative pressure wound therapy? A randomized controlled trial in patients with extremity ulcers. *Ann Med Surg* 61:73-80.
 12. Chen K, Lin JT, Sun SB, Lin J, Kong JZ, Tian NF (2018) Vacuumassisted closure combined with a closed suction irrigation system for treating postoperative wound infections following posterior spinal internal fixation. *J Orthop Surg Res* 13(1):321.
 13. Delaat EH, Van Den Faster wound healing with topical negative pressure therapy in difficult to heal wounds: a prospective randomized control. *Ann Plast Surg* 2011;67(6):626-31. Led trail Boogaard MH, Spauwen PH, van Kuppevelt DH, van Goor H, Schoonhoven L.
 14. Birke-Sorensen H, Malmso M, Rome P et al. Evidence-based recommendations for negative pressure wound therapy: treatment variables (pressure levels, wound filler and contact layer) – steps toward an international consensus. *J Plast Reconstr Aesthet Surg* 2011;64(Suppl.):S1-S16.
 15. BurkhardLehmar, Wim Fleischmann, Rolf Becker, Gerrold N. Jukema. First experiences with negative pressure wound therapy and instillation in the treatment of infected orthopaedic implants: a clinical observational study. *International Orthopaedics (SCIOT)* 2011;35:1415-1420.
 16. Hyun-Joo Lee, Joon Woo Kim¹, Chang Wug Oh, Woo Kie Min, Oog Jin Shon, Jong Keon Oh et al. Negative pressure wound therapy for soft tissue injuries around the foot and ankle. *Journal of Orthopaedic Surgery and Research* 2009;4:14.
 17. Jens Kelm, Eduard Schmitt, Konstantinos Anagnostakos: Vacuum-assisted closure in the treatment of early hip joint infections. *Int J Med Sci* 2009;6(5):241-246.