E-ISSN: 2616-3470
P-ISSN: 2616-3462

www.surgeryscience.com
2020; 4(4): 14-17
Received: 19-08-2020
Accepted: 26-09-2020

Dr. Anurag Tiwary
Assistant Professor, Department of General Surgery, D.Y Patil University School of Medicine, Navi Mumbai, Maharashtra, India

Dr. Ajay Gujar
Professor and Head, Department of General Surgery, D.Y Patil University School of Medicine, Navi Mumbai, Maharashtra, India

Dr. Nida Khan
Senior Resident, Department of General Surgery, D.Y Patil University School of Medicine, Navi Mumbai, Maharashtra, India

Dr. Pragati Singhal
Fellow in Surgical Oncology, TMH, Kolkata, West Bengal, India

Dr. Sandip
Assistant Professor, Department of General Surgery, D.Y Patil University School of Medicine, Navi Mumbai, Maharashtra, India

Dr. Sharique Ansari
Assistant Professor, Department of General Surgery, D.Y Patil University School of Medicine, Navi Mumbai, Maharashtra, India

Dr. Ashwanth Kumar
Junior Resident, Department of General Surgery, D.Y Patil University School of Medicine, Navi Mumbai, Maharashtra, India

Corresponding Author:
Dr. Anurag Tiwary
Assistant Professor, Department of General Surgery, D.Y Patil University School of Medicine, Navi Mumbai, Maharashtra, India

Vaccum assisted closure of diabetic ulcers

Dr. Anurag Tiwary, Dr. Ajay Gujar, Dr. Nida Khan, Dr. Pragati Singhal and Dr. Sandip

DOI: https://doi.org/10.33545/surgery.2020.v4.i4a.531

Abstract
Diabetes affects more than a 100 million people worldwide. Around 10.5% of Americans and 10.9-14.2% of Indians are diabetics, and therefore susceptible to its complications of microangiopathy, neuropathy and poor wound healing, all of which contribute to high incidence of ulcers, particularly of the distal extermities, even after trivial trauma. Management of these ulcers require systemic management of diabetes and its complications in these patients. Vaccum assisted closure of Diabetic Ulcers, by application of its principle of Negative Pressure to the wound has gained popularity due to early appearance of granulation tissue, facilitation of secondary wound closure and decreased duration of hospital stay. We studied 80 patients with diabetic ulcers from December 2017 to November 2019, randomly assigning them to two groups, Vaccum Assisted Closure versus conventional moist wound dressing to ascertain any possible benefit of Negative Pressure wound therapy with respect to appearance of granulation tissue, secondary closure after the therapy, interval for skin grafting, duration of hospital stay.

Keywords: Diabetic ulcers, NPWT, Vaccum assisted closure

Introduction
Argenta and Morykwas were the first to report Vaccum Assisted Closure of wounds in 1997, wherin removal of oedema, production of granulation tissue and softening of surrounding tissue facilitating early wound healing and skin grafting were observed [1].Vaccum dressing involved thorough debridement, adequate hemostasis and application of sterile foam dressing with the machine delivering negative pressure at 50 to 125 mmHg. The advantage of NPWT is decrease in wound volume, depth, treatment duration and cost [2]. NPWT also enables earlier secondary closure of wound and skin grafting as compared to conventional saline dressing [3].

Material and Methods
Patients presenting with non-healing ulcers with a past history of diabetes mellitus or diagnosed with the same after admission, localised abscesses in diabetics resulting in large wounds post drainage, post amputation stumps were all included in the study. Out of the 80 patients, 40 were randomly assigned to vaccum therapy and 40 to conventional saline dressing. Proper consent was taken from patients before including them in the study.

Inclusion criteria: Any non-healing wound in a diabetic patient, including post traumatic ulcers, post incision and drainage of abscess, post debridement or amputation of a diabetic foot.

Exclusion criteria: Wounds with critical limb ischemia and non-diabetic wounds weren't included in the study. All patients underwent baseline Hemogram, Fasting and Post prandial blood sugar levels, HbA1C levels, X rays of relevant bones and joints, Arterial doppler of limb involved. Co morbidities and gylcemic control were addressed during the admission. Patients underwent complete neurological examination and opthalmological evaluation. All wounds were surgically debrided before subjecting them to either group.
Patients subjected to Vaccum Dressing were given NPWT for 6 continuous days, wheras the control group was given daily saline moistened gauze dressing. Antibiotics were initially broad spectrum and later given according to culture sensitivity reports.
Vaccum device consisted of the following parts, 1.Sponge, 2.Semipermeable dressing, 3.Tubing, 4.Vaccum machine. The pressure applied was 50 to 125mmHg, intermittently.

The vaccum machine had a cannister attatched to it that collected the effluent from the wound. Cannisters were changed once filled with effluent, with deeper wounds requiring more frequent changing than comparatively superficial ones. NPWT dressing was done under aseptic precautions. Patients and relatives were educated about the basic working of the setup, and to report if the machine stopped working or if the effluent was excessive. They were also taught to disconnect the tubing temporarily when they mobilised and to keep the dressing dry externally.

Result and Discussion

At the end of 6 days, patients subjected to Vaccum dressing had decreased depth of the wound, decrease in total surface area of the wound, decreased surface area of wound, decreased discharge from the wound, earlier skin grafting or secondary closure, decreased duration of hospital stay. Mean age of Case group was 56 years, 55.5 years in control group. 97.5% of patients in case group were males, while 100 % were males in control group. There was more than 50% decrease in depth of the wound in case group in 87.5% of patients while only 65% of patients in control group had such a significant decrease in depth of the wound. Average number of days needed for skin grafting or secondary closure was 12 in NPWT group compared to 20 in the control group with saline dressing.

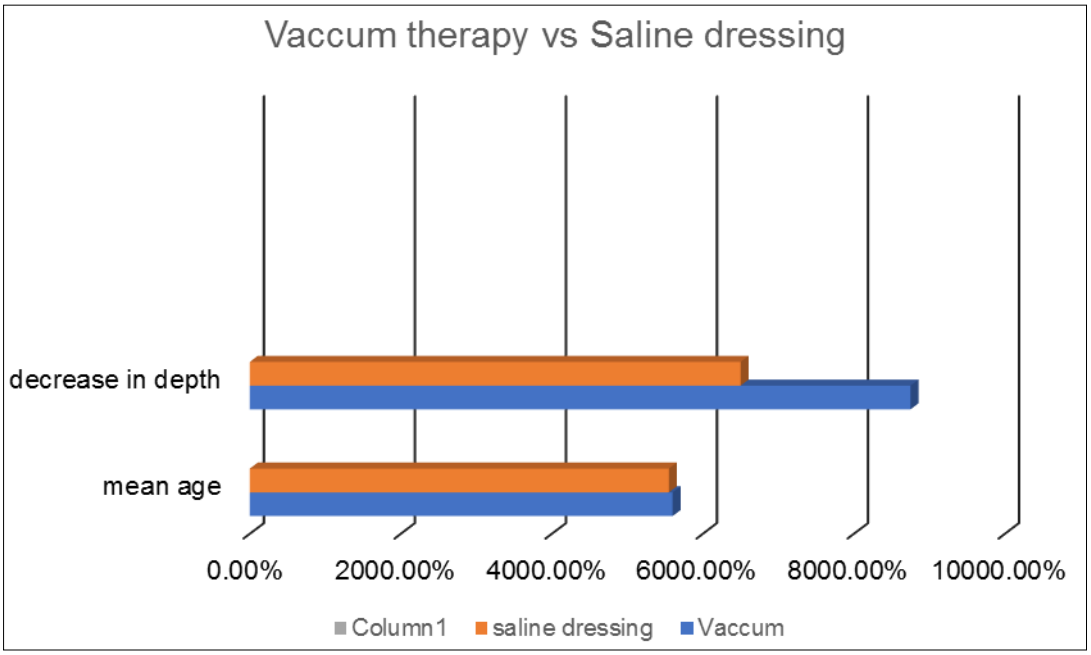

Fig 1.

Various theories have been postulated about the mechanism of action of vaccum therapy. *In vitro* studies have revealed that cells allowed to stretch, tend to divide and proliferate, in the presence of mitogens, wheras retracted cells remain quiescent [4]. NPWT provides a moist environment which is favourable for re epithelisation, angiogenesis, promotion of formation of granulation tissue and protects the local nerves [5]. There is a decrease in oedema which decreases interstitial pressure and positively affects microvascular occlusion and lymphatic drainage, increasing availability of oxygen nutrients and antibiotics reaching the wound [6]. Wound exudate is high in metalloproteinases, which are unsuitable for healing as they degrade proteins that are not normally their substrate, growth factors, receptors and extracellular matrix proteins. NPWT promotes an improvement in the balance between proteases and their inhibitors [7]. There is an increase in blood flow due to increase in vascular diameter, blood flow velocity and diameter [8]. NPWT promotes early angiogenesis and appearance of granulation tissue. There is a mobilisation of endothelial progenitor cells (EPC), higher beta fibroblast growth factors (bFGF), thus promoting healing [9]. The foam in Vaccum therapy transmits a negative force to surrounding tissues, thus deforming extracellular matrix and activating tyrosine kinase and growth and transport genes [10].

NPWT can be used in post-traumatic, diabetic, pressure, post-surgical dehiscent wounds. However it cannot be used in infected wounds and wounds with critical limb ischemia. Lower pressures are used in case of decreased perfusion of affected limbs. Debridement prior to application of Vaccum dressing with proper antibiotic coverage is imperative, as without debridement, infection will worsen with vaccum application. Hemostasis should be achieved post debridement and prior to application of vaccum therapy. Also, diabetics due to other associated complications associated with the disease tend to be on antiplatelets or anticoagulants or both and are at a risk of bleeding, therefore monitoring of output from vaccum device is essential. NPWT gives a significant decrease in wound size, earlier appearance of granulation tissue, earlier closure of wound or grafting is possible. It also decreases hospital stay and morbidity. However it has its cons, particularly cost of the device (70-130 USD, per application), mild pain or discomfort and irritation of surrounding skin due to barrier layer and abrasions associated with improper application of foam.[11]. Alternatively a combination of NPWT with topical wound oxygen therapy has also been tried.

Fig 2.

Fig 3.

Fig 4.

Fig 5.

These can be named as 'post Vaccum application'

Fig 6.

Conclusion: Vaccum Dressing yields better results compared to conventional dressing for diabetic ulcers in terms of earlier appearance of granulation tissue, decrease in depth of wound and from wound, decrease local oedema, facilitation of earlier secondary closure or skin grafting, decreased hospital stay and overall morbidity.

References

1. Argenta LC, Morykwas MJ. "Vacuum-assisted closure: a new method for wound control and treatment: clinical experience 1997,563-577.
2. Agarwal Pawan, Kukrele Rajeev, Sharma Dhananjaya. Vacuum assisted closure (VAC)/negative pressure wound therapy (NPWT) for difficult wounds: A review. Journal of Clinical Orthopaedics and Trauma 2019,10. 10.1016/j.jcot.2019.06.015.
3. Vaidhya N, Panchal A, Anchalia MM. A New Cost-effective Method of NPWT in Diabetic Foot Wound. Indian J Surg 2015;**77:**525-529. https://doi.org/10.1007/s12262-013-0907-3
4. Saxena Vishal *et al*. "Vacuum-assisted closure: micro deformations of wounds and cell proliferation." Plastic and reconstructive surgery 2004;114.5:1086-1096.
5. Bryan J. Moist wound healing: a concept that changed our practice. J Wound Care 2004;13:227-228
6. Simman R, Forte R, Silverberg B, Moreira-Gonzales A. A comparative histological pilot study of skin graft tack with tie-over bolster dressing versus vacuum assisted closure in a pig model. Wounds 2004;16:76-80
7. Ratios of activated matrix metalloproteinase-9 to tissue inhibitor of matrix metalloproteinase-1 in wound fluids are inversely correlated with healing of pressure ulcers. Ladwig GP, Robson MC, Liu R, Kuhn MA, Muir DF, Schultz GS Wound Repair Regen 2002;10(1):26-37.
8. Effects of vacuum-assisted closure on wound microcirculation: an experimental study. Chen SZ, Li J, Li XY, Xu LS Asian J Surg 2005;28(3):211-7.

9. Negative pressure wound therapy is associated with up-regulation of bFGF and ERK1/2 in human diabetic foot wounds. Yang SL, Han R, Liu Y, Hu LY, Li XL, Zhu LY Wound Repair Regen 2014;22(4):548-54.
10. Effect of strain on human keratinocytes *in vitro*. Takei T, Rivas-Gotz C, Delling CA, Koo JT, Mills I, McCarthy TL. Sumpio BE J Cell Physiol 1997;173(1):64-72.
11. Meloni M, Izzo V, Vainieri E, Giurato L, Ruotolo V, Uccioli L. Management of negative pressure wound therapy in the treatment of diabetic foot ulcers. World J Orthop 2015;6(4):387-393. Published 2015 May 18. doi:10.5312/wjo.v6.i4.387