ORIGINAL RESEARCH

Evaluation between Ryles Tube technique in Negative Pressure Wound Therapy and conventional dressings

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ABSTRACT
Aims and Objectives: To assess the efficacy of Negative-pressure wound therapy dressing using a locally constructed Negative-pressure wound therapy device and comparing it with regular gauze dressings for large wounds. **Materials and Methods:** A prospective observational study was done ,80 patients with non-healing leg ulcers were recruited from the Department of General Surgery, Government Wenlock Hospital, Mangalore Karnataka, India during the period of March 2021 to March 2022. All patients with Chronic leg ulcers i.e. defect in the skin below the level of knee persisting for more than six weeks and showing no tendency to heal after three or more months were included in study.Patients with osteomyelitis, peripheral vascular disease, or malignancy were excluded. Of the 80 patients, 40 patients received NPWT using Ryles tube dressings, 40 patients were treated with regular conventional dressings. **Results:** The use of vacuum therapy in large wounds resulted in improved wound healing as evidenced by faster healing, shorter hospital stay and improved graft uptake compared to conventional dressing. **Conclusion:** Ryles tube technique NPWT dressing is a safe and economical method for treatment of large wounds.

Key words: NPWT, VAC,Dressings

INTRODUCTION

Management of chronic and difficult wounds has been a challenge to the medical profession in general and plastic surgeons in particular. Innovativeness has been the key to successful wound management through ages. Sutures are being used since 5000 years to bring about apposition of wound edges and achieve healing by primary intention. Importance of asepsis to promote wound healing has been recognized since the middle of 19th century. Skin graft to cover extensive wounds has been tried since the early part of 18th century. Use of flaps, though known to man for 2500 years was used for wound management in the early part of the present century.

Foot ulcers are common among people with diabetes, with a lifetime risk of 15% according to some estimates, and possibly as high as 25% based on other data. These ulcers are notoriously challenging to treat, and they frequently heal incompletely or slowly. These sores frequently worsen, necessitating removal of the affected limb. Diabetic foot is the leading cause of amputations that are not caused by trauma.[1]

Diabetic foot ulcers can be treated with a variety of nonsurgical methods, including re-vascularization, local wound therapy, unloading, and others. In addition to lowering quality of life and increasing the risk of complications like infection, ulcers can be fatal if left untreated.[2]

Diabetic foot ulcers can be treated using a variety of dressing materials and treatments, although their effectiveness varies. The patient and healthcare system both incur substantial costs due to the necessity of dressings for several days or weeks.[3]

The past three decades have seen an increase in the average life expectancy and with it, its attendant medical and surgical complication. Man's dependence on machine has resulted in a phenomenal increase of industrial and vehicular accidents. Therefore, with the aim to control the wound, minimize complication, curtail cost and minimizing hospital stay, several modalities of treatment have been tried. Among these are the use of **hyperbaric oxygen, application ofelectrical stimulation** and use of **sheets of altered cultured Keratinocytes.** Application of vacuum has been the most recent among them.

The most cutting-edge method for healing diabetic foot ulcers is called negative-pressure wound treatment. According to its proponents, it speeds up the recovery process. By applying a negative pressure to the area, all collections (serum, pus, and blood) are drawn out, and the wound's blood supply is increased, hastening the healing process. [4]

By removing contaminated fluid from the injury site, purulence is reduced in absolute terms. Using this method, an open wound can be closed under medical supervision. Tissue oedema and induration appear to be mitigated. Reductions in the number of bacterial colonies were statistically significant.

Many factors prevent their widespread use, including their high cost, lack of visibility of the wound bed during treatment, requirement of a specialized suction machine, maceration of the skin from the wound's moist environment, risk of anaerobic infection, unpleasant odour, and difficulty in manipulating the wound's environment once the dressing has been applied.

To provide negative pressure wound care in our setting, we put Ryle's tubes or suction tubings into the dressings made from locally sourced materials such plastic leggings, condoms, gloves, balloons, food wrappers, and so on.

AIMS AND OBJECTIVES OF THE STUDY

AIM

Using a locally fabricated NPWT device, we will compare the performance of this alternative dressing for big wounds with that of conventional gauze dressings.

OBJECTIVE

- Study of NPWT using Ryles tube
- Evaluation between Ryles tube technique in NPWT and Conventional dressings

METHODOLOGY

Prospective Observational Study done during March 2021 to March 2022.Study subjects were patientsfromhospitalsattachedtoKasturbaMedicalCollege,Mangaluru(GovernmentWenlock hospital,KMCHospital, Attavar) with non-healing chronic leg ulcers. Patients with osteomyelitis, peripheral vascular disease and malignancy were excluded. A total of 80 patients (40 in each group) were selected satisfying the inclusion and exclusion criteria.

Institutional Ethical committee approved the study(IEC KMC MLR 01-2021/06). Informed written consent from patient for participation in study was obtained. Relevant clinical history and findings was noted. Debridement of the wounds was done.

NPWT GROUP

- **Materials needed**-locally available foam, ryles tube, adhesive plaster/Opsite, tubings, wall suction and gauge.
- **Procedure**- Locally availableFoam was autoclaved and was cut according to the shape of the wound and Ryle's tube was inserted between the two layers. Plaster adhesive was used to seal the area surrounding the foam. Various tubes linked the ryle's tube to the wall suction. The -125 mm Hg of negative pressure was selected as the maximum. We provided constant negative pressure for 48 hours, and the patient was instructed to detach the tube before ambulating. Once 3-7 days had passed, the dressing was removed.
- **-Conventional dressing group** – Regular dressings with saline and betadine was done daily.
- No. of dressings and no. of days of dressings was noted and compared among the both groups.

RESULT

Majority of patients belonged to 51-60 years age group in NPWT as well as conventional dressing group with mean age 55.18± in NPWT and 54.88± in conventional dressing group. **(**Figure 4) There were 82.5 % male and 17.5% female with male female ratio 4.7:1 in NPWT group and 85 % male and 15% female with male female ratio 5.7:1 in conventional dressing group.**(**Table 1)Most of the patients in the NPWT as well as conventional dressing group were having Diabetes mellitus, followed by cellulitis, only 10% cases were due to trauma in NPWT group and 12.5 % in conventional dressing group. **(**Figure5) Numbers of days in appearance of good granulation tissue were between 11 to 40 days in NPWT group but it was more in conventional dressing group i.e. between 31 to 70 days.**(**Figure 6) Average time for appearance of good granulation tissue in NPWT group was found 24.14 days and in conventional dressing group was found 50.77 days.

Figure 1: Pre NPWT wound

Figure 2: NPWT using Ryles tube technique

Figure 3: Post NPWT wound

Figure 4-Distribution of patients according to Age

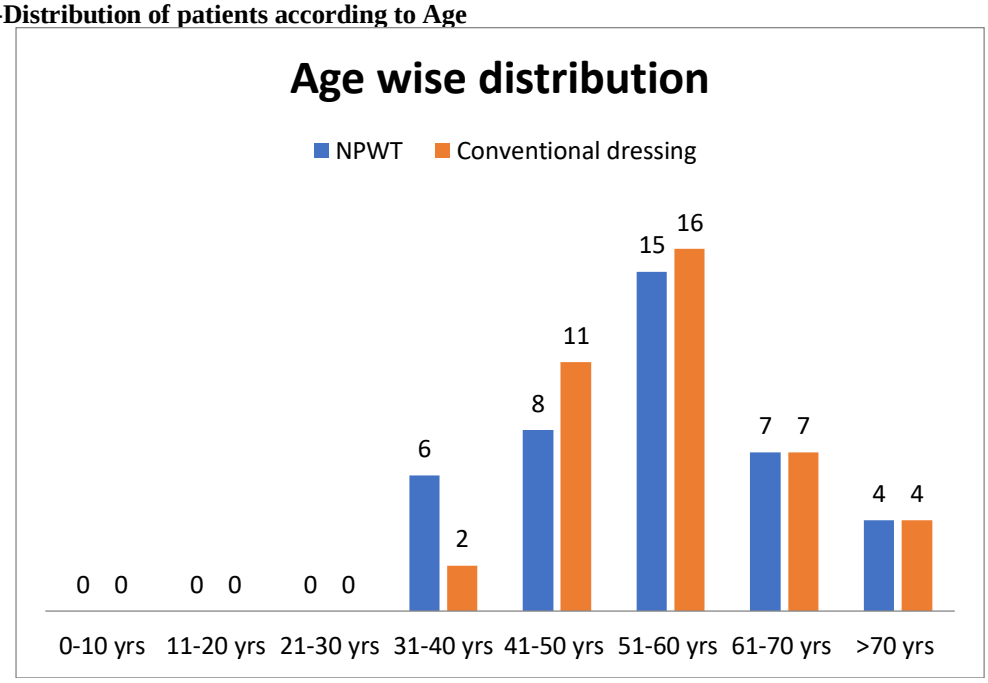


Table 1: Gender Wise Distribution of Patients

S. No.	Gender	NPWT (n=40)		Conventional dressing (n=40)	
1	Male	33	(82.5)	34	(85%)
2	Female	7	(17.5%)	6	(15%)

Figure5: Etiology of wound in NPWT Group and Conventional Dressing Group

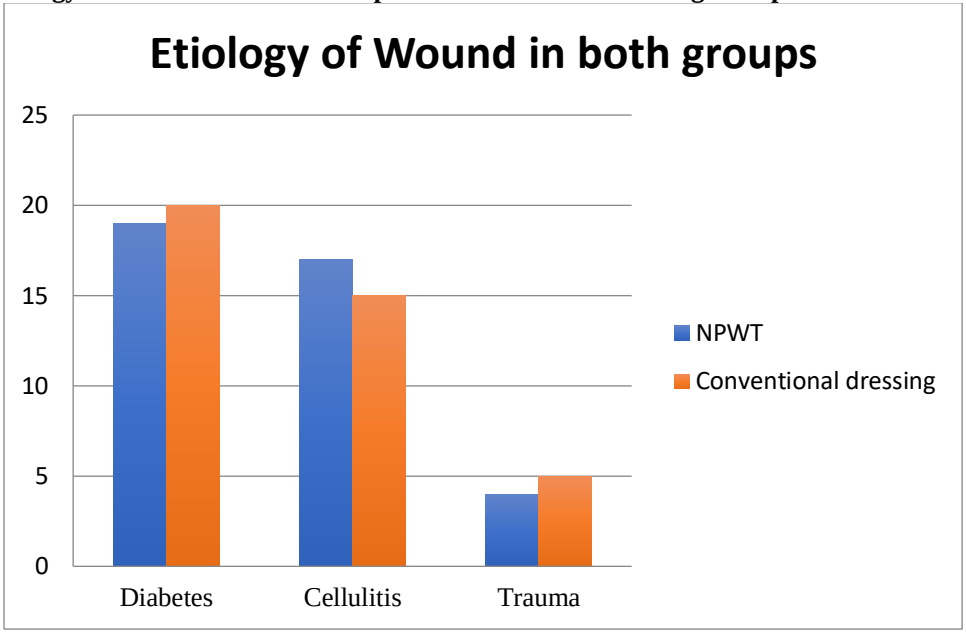
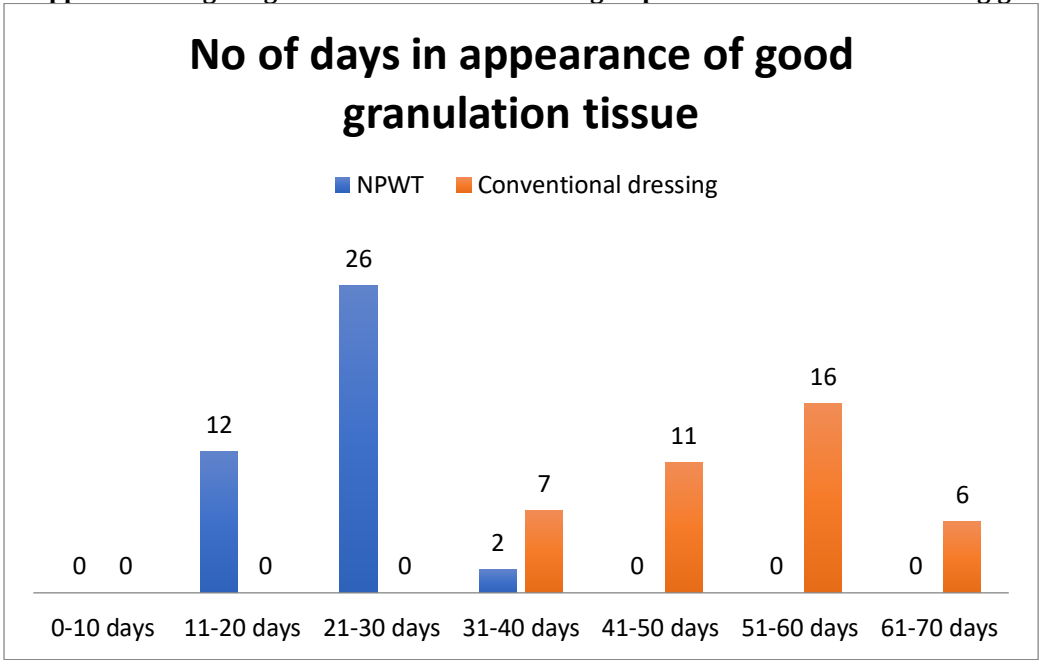


Figure 6: Appearance of good granulation tissue in NPWT group andin Conventional dressing group



In all NPWT group patients number of dressing were very less (< 5) as compared to conventional dressing group patients (31-70). **(**Figure 7)Average number of dressing in NPWT group was 3.9 and in conventional dressing group was 49.25 . In contrast to the standard dressing group, patients in the NPWT group required fewer hospital days during their treatment. The NPWT group had a shorter mean hospital stay (24.14 vs. 67.92 days) than the control group. **(**Table 2)

Figure 7: Number of Dressing in NPWT and in Conventional dressing group

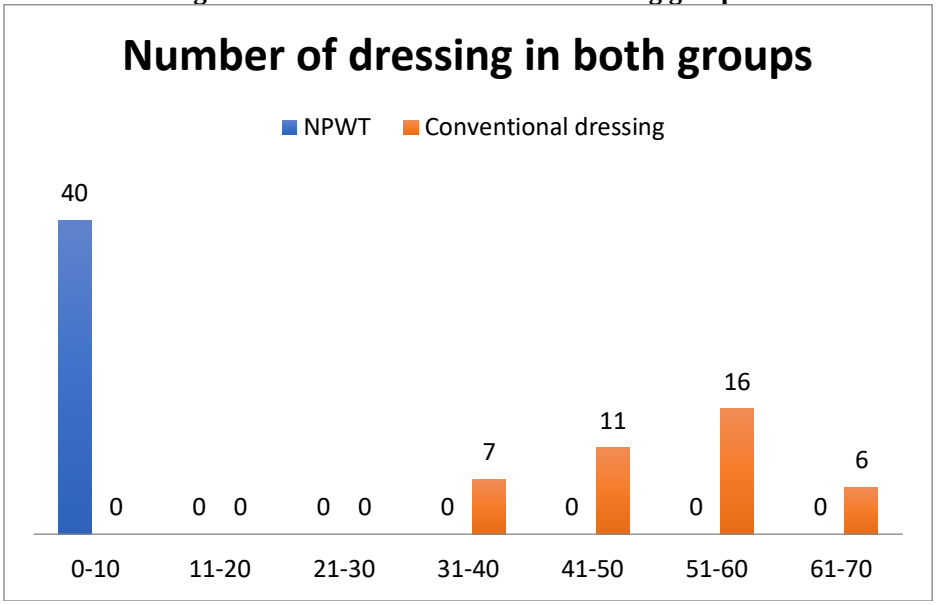


Table 2: Total days of Hospital stay

Days of hospital stay	NPWT group (n=40)	Conventional dressing group (n=40)
0-10	0	0
11-20	12 (30%)	0
21-30	27 (67.5%)	0
31-40	2 (5%)	0
41-50	0	2 (5%)
51-60	0	7 (17.5%)
61-70	0	13 (32.5%)
>70	0	18 (45%)

DISCUSSION

WOUND MANAGEMENT

Closed wound: Closed wound require no specific management and no treatment is of proven value. The wound subside with time with minimal or no scarring.

Open wounds: The ideal from of management of an open wound is surgical inspections, cleaning and primary closure under appropriate anaesthesia. The wound should be thoroughly inspected to ensure that there is no damage to the deeper structure. Damage to deeper structures must be repaired. All dirt and foreign material must be removed. The term 'debridement' is in general use to describe the surgical cleaning of wound. All patient sustaining open wound should have prophylaxis against tetanus and antibiotics must be administered when there is significant contamination. In wounds where primary closure is not possible, application of split skin grafting should be done early as possible.

Injuries to special Tissue (Bone, Tendon, Joints, etc.): Special precautions should be taken to ensure proper cleaning of wound. If possible primary closure should be attempted. In case this is not possible coverage of the tissue should be attempted with skin grafting or flap.

Chronic wounds: The cause of the chronic wound should be identified. If possible, the treatment of the cause should be started. The general condition of the patient can be improved with nutritional support, along with blood transfusion if necessary. Pressure diapering cushions and special mattress should be added and patient should be asked to move or to be changed positionsfrequently. Surgical debridement of devitalized tissue should be done oftenly. If wound is unhealthy, the usual practice is to clean it with hydrogen peroxide and Eusol. For clean wounds, a saline dressing is adequate. The exposed bone, flap cover is planned. In the absence of exposed bone wound is allowed to granulate followed by split skin grafting.

Negative pressure wound therapy (NPWT): NPWT approach involves applying a low atmospheric pressure directly to the wound surface, creating a vacuum, and then draining the exudates into a separate container through a tube. Before beginning NPWT, a comprehensive debridement procedure is performed. In order to remove the exudates, a vacuum device is employed, creating a sub-atmospheric pressure of around 125 mmHg. This treatment aids in wound healing by decreasing bacterial load and

inhibitive cytokines and increasing oxygenation and cellular proliferation and granulation.[5]

This current research was initiated to compare the effectiveness of NPWT dressings made from locally sourced materials to those made from standard gauze for big wounds. There were several measurements taken and compared between the NPWT and the traditional clothing group.

Age: The age of patients ranged from the fourth to the seventh decade. There was a preponderance of the patient in their sixth decade. No particular preference to certain age group of patients were shown during selection of patient. Patients were selected randomly keeping in mind the patients' stable general condition and the cumulative benefit that this particular treatment would give to the patient. The preponderance in number of a certain age group in the study was simply because of the numerical strength of this group in the wards.

Sex : An overwhelming majority of the patients in the NPWT as well as conventional dressing group were males. Again, no particular preference was shown to a particular sex while selecting patients. The numerical advantage was due to the larger number of male patients. The dominance of male in the outdoor activities could be the reasons for them being prone to trauma.

Aetiology: Diabetes mellitus and cellulitis were the major cause of the patients of the study. Most of the patients in the NPWT as well as conventional dressing group were having Diabetes mellitus, followed by cellulitis, only 10% cases were due to trauma in NPWT group and 12.5 % in conventional dressing group.

Purpose for Application of Vacuum: The purpose for applications of NPWT were Appearance of good granulation tissue early, appearance, decrease of wound size and depth, decrease the secretion from wound, alter the microbial status etc), to improve general condition of wound and do skin cover early with split skin graft application.

Argenta and **Morykwas** et al. (1997) used vacuum for the management of chronic wounds, sub-acute wounds and acute wounds. [6]. **Fleischman** et al. (1993) used vacuum sealing for management of open fracture. [7]. **Voichet** and **Megalon** described vacuum assisted closure a non-invasive negative pressure healing indicated in treatment of chronic wound. **Blackburn** et al. (1998), **Schneider** et al. and **Argenta** described using vacuum for the securing of skin graft.

Appearance of Wound following Vacuum Application: In the present the study applications of NPWT were found to have a beneficial effect on the wound. Two parameters (appearance and presence of slough) were improved. It was found that in 90% of the patients the granulation tissue by 30th day. Granulation tissue (100%) appeared at the end of the 2-5th dressing. In the conventional dressing group, none of good granulation tissue appeared up on the thirtieth day. Out of 40 patients only 7 (17.5%) had good granulation tissue at the end of 40 days. Application of NPWT was thus found to have a beneficial effect in appearance of good granulation tissue and cleaning the wound as well as slough.

Number of Dressing: Applications of NPWT was found to have a beneficial effect in number of dressings clearing up the floor of the wound and appearance of good granulation tissue. NPWT was found to favour granulation tissue formation.

NPWT application was found to enhance graft take by increasing vascularity, decreasing movement, increasing the adherence of the graft to its bed and removal of toxic factors. **Blackburn** et al. (1998) **Argenta**, **Morykwas** et al. (1996) discovered promising results suggesting this therapy is highly effective, with enhanced graft take due to total immobility of the graft along with reduced bacterial contamination, fluid build-up or graft bridging.

Cost Factor: The estimated cost of the materials required during the 30 days period of NPWT application was Rs. 500/- This included the cost of around the sheets of adhesive dressing (Opsite 15 X 20 cms). This compared favourably with the cost of daily dressing for an extended period which the patient may have to bear, if the usual mode of treatment is undertaken, reduced duration, as well as cost of hospital stay.

Dressing Time: The time required to apply NPWT for the first dressing was around 20 minutes. Each subsequent application took about 10 minutes time.

DRAWBACKS

The drawbacks of the procedure observed in the study were mainly excessive bleeding during change of dressing and mild discomfort to the patient. It was observed that there was some amount of bleeding from the wound with each change of dressing. This could be attributed to the excess vascularity at the wound and in-growth of granulation tissue into the dressing following NPWT application. The bleeding was not alarming and application of local pressure was enough to stop it. A few patients complained of mild discomfort which could not always be attributed to the NPWT application. In some cases, verbal assurance to the patient suggesting his betterment was sufficient and pain usually subsidedwithin an hour.

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