



Research Article

EFFECTIVENESS OF NEGATIVE PRESSURE WOUND THERAPY AS A DRESSING OVER OPEN WOUNDS-A COMPARATIVE STUDY

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ABSTRACT

Background: Chronic wounds are a cause of increased morbidity as the expenditure incurred due to prolonged treatment is high. Negative pressure wound therapy (NPWT) is a relatively new technique that converts an open wound into closed environment by applying intermittent negative pressure. A specialised wound dressing is applied to provide an airtight seal which isolates it from the external environment. The exudate from open wounds is removed through a sealed dressing and tubing which is connected to a collection chamber. This technique has revolutionised the care of acute and chronic wounds resulting from trauma, diabetic ulcers and non-specific causes.

Negative pressure technology subsequently became known by several trade names including vacuum assisted closure (VAC), topical negative pressure (TNP), Vacuum sealing technique (VST), and sealed surface wound suction (SSS). NPWT is commonly used in place of more traditional dressing technique using cotton gauze. It is an inexpensive product which can keep wounds clean and covered and absorbs exudate. NPWT is a better alternative that reduces infection and promotes early wound closure. In this study NPWT was used to determine their effect in healing process of acute and chronic wounds.

Materials And Methods: The study is designed to compare negative pressure wound therapy (NPWT), which is a newer non-invasive system, with conventional silver stream dressing in the treatment of acute and chronic wounds. In this prospective and open label study 60 patients were included and were divided into 2 groups, in which one group was given with the negative pressure wound therapy (NPWT) and other group was given with silver stream solution. Data regarding wound size in cm, granulation tissue formation, effect of early wound closure were taken as output parameters of the study.

Results: Among 60 study subjects 30 were taken as a control group and 30 as study group. After observation and follow up negative pressure wound therapy group demonstrated significant reduction in wound size, granulation tissue formation and wound closure compared to silver stream solution.

Conclusion: Negative pressure wound therapy is a newer non-invasive system that uses controlled negative pressure to promote wound healing. It is a more dynamic alternative that enhances granulation tissue formation and reduces bacterial infection and promotes early wound closure. Early wound closure leads to decreased hospital stay, reduced antibiotic use and lower morbidity.

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INTRODUCTION

Wound healing is a normal process in human body. Prolongation in this process can lead to delayed wound healing or a non-healing chronic wound.¹ Improper or impaired wound healing can occur due to many factors that interfere within one or more phases.

Chronic wounds are a cause of increased morbidity as the expenditure incurred due to prolonged treatment is high.

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Negative pressure wound therapy (NPWT) is a relatively new technique that converts an open wound into a closed environment by applying intermittent negative pressure.² A specialised wound dressing is applied to provide an airtight seal which isolates it from the external environment. This technique has revolutionised the care of acute and chronic wounds resulting from trauma, diabetic ulcers and non-specific causes.

The exudate from open wounds is removed through a sealed dressing and tubing which is connected to a collection chamber. Negative pressure technology subsequently became known by several trade names such as Vacuum Assisted Closure (VAC), Topical Negative Pressure (TNP), Vacuum

Sealing Technique (VST), and Sealed Surface Wound Suction (SSS). NPWT is commonly used in place of the more traditional dressing technique using cotton gauze. It is an inexpensive product which can keep wounds clean, covered and absorbs exudate; however it can lead to bacterial contamination once it is soaked.

NPWT is a better alternative that reduces infection and promotes early wound closure. It has been recommended for virtually all kinds of acute and chronic wounds such as: pressure sores, diabetic ulcers, incisional NPWT, non-healing traumatic wounds, infected wounds, necrotising fasciitis and over grafted skin.³ Depending on treatment choice and nature of the wound the duration of therapy varies from few days to weeks.

NPWT acts by reducing oedema, promoting perfusion, removing infectious materials, and drawing wound edges together.⁴ Compared to conventional therapy NPWT results in rapid development of granulation tissue and bacterial clearance from the wound. This will facilitate early definitive treatment such as skin grafting or flap cover.

Chronic wounds mainly affect the elderly and those with multiple co-morbid factors. Despite the use of modern dressings, some of these wounds have prolonged healing time resulting in increased morbidity. Hence NPWT has emerged as the treatment of choice for chronic wounds from various causes.

MATERIALS AND METHODS

60 patients were observed during the study period from November 2018 to April 2019.

Study Design: It is a comparative, open label study. It was a prospective study, where 60 patients were included. One group was treated with NPWT (n=30) and the other with Silver stream dressing (n=30).

STUDY METHODOLOGY

After taking the institutional ethics committee clearance, informed consent was taken. Demographic data, brief medical history was taken along with clinical examination (i.e CBP, ESR, CRP) were done for all the patients enrolled in the study. The presence of co-morbid factors such as diabetes, hypertension, peripheral vascular disease was duly documented. The progress of wound healing was monitored by measuring the wound length and breadth. An approximate assessment of wound area was calculated by this method.

Inclusion criteria & Exclusion criteria

Inclusion criteria as follows

Patients with any age group. Patients with acute, chronic or surgical wounds. Patients who comply to participate in the study with a written informed consent form. The patients who met these study criteria were enrolled in the study.

Exclusion criteria were the presence of infection with discharging pus, active bleeding and malignancies.

The length and breadth of wounds of different aetiology are measured using the wound measuring scale. The aetiology may be diabetic (Fig 1a), traumatic (Fig 1b) or chronic (Fig 1c).



Fig 1a diabetic wound



Fig 1b traumatic wound



Fig 1c chronic wound

After thorough lavage of wound with the normal saline, negative pressure dressing is applied with pressure between 125-150 mmHg. Uniform pressure is applied all over the wound without any leaks (Fig 2a & b).



Fig 2a NPWT dressing over Surgical wound



Fig 2b NPWT dressing over chronic wound

Dressings are changed once in 48-72hrs and reapplied until healthy granulation tissue is formed (Fig 3a & b) and the wound bed is suitable for secondary procedures such as suturing, split skin graft or flap cover.

procedures, the wound healing took place between an average of 5 to 12 weeks (4 a b & c).



Fig 3a Granulation tissue regeneration of diabetic wound



Fig 3b Granulation tissue regeneration of surgical wound



Fig 4a Healed diabetic wound after 10 weeks of follow up



Fig 4b Healed traumatic wound after 11 weeks of follow up



Fig 4c Healed after NPWT and suturing at 7 weeks of follow up

RESULTS

The parameters which were included in our study are:

Age, Gender, BMI, CBP, ESR, CRP, Wound measuring scale. The study comprises of 60 patients, out of which 30 underwent NPWT applications. Average number of NPWT applications in our study is 3 per patient (maximum 8 dressings and minimum 2 dressings). Male patient comprised of 84% and females comprised of 16% in our study sample.

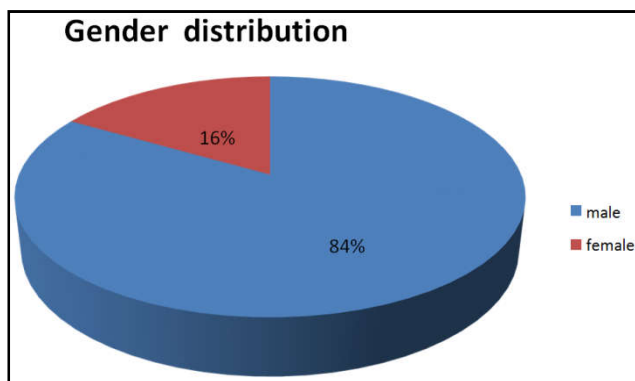


Chart 1 Pie chart showing gender wise distribution of patients

Overall patient profiles with respect to age, sex, height, weight, comorbidities and range of infection were similar between both treatment groups. Following secondary

Statistical Analysis

Co-Efficient of Variance

Test Group

Table 1 Coefficient of variance for test group

	Descriptive Statistics				
	N	Minimum	Maximum	Mean	Std. Deviation
NO_OF_NPWT	8		6.00	1.3750	2.13391
Valid N (listwise)	8	.00			

Coefficient of variance= standard deviation/mean*100
2.13391/1.375*100
133

Control Group

Table 2 Coefficient of variance for control group

	N	Minimum	Maximum	Mean	Std. Deviation
NO OF DRESSINGS	30				
Valid N (list wise)	8	.00	1.00	.5000	.50855

Coefficient of variance= standard deviation/ mean* 100
0.50855/0.5000*100
50.1

We obtained values by calculating co-efficient of variance for test and control groups, in which coefficient of variance is less(i.e., 133) for test group compared to control group (i.e.,501.1).

Hence NPWT more efficient in comparison to Silver Stream Dressing.

DISCUSSION

In this study 60 patients were randomly assigned into two groups; one group underwent NPWT and other group was given Silver stream solution. Patients were assigned treatment modality randomly in an alternate manner. Patients in both study and control group were evaluated by the same parameters; age, sex, BMI, wound size, granulation tissue formation and reduction in wound size. The data was then analysed with the help of SPSS version 16 applying coefficient of variance. All categories of wounds studied showed rapid wound healing compared to control group. Functional restoration of the wound depends on multiple interdependent processes.⁵Wound healing involves complex interactions, biochemical mediators and extracellular matrix molecules.⁶ Bacterial slime and exudates from the wound are more rapidly cleared with the help of negative pressure dressings. It has an advantage of rapid granulation tissue formation, a property that has a big advantage in implant related infections. Early application of NPWT in postoperative infections results in rapid resolution of infection, retention of implant and restoration of the soft tissue envelope. Once soft tissue integrity is achieved the fracture will progress to union.⁷ Wound healing is influenced by vascular supply, matrix molecules and rate of new capillary formation. Disruption of proliferation, angiogenesis, chemo-taxis, migration, gene expression, proteinases may adversely wound healing, resulting in a chronic wound. On application of sub atmospheric pressure there is an increase of blood flow and reduced bacterial colonization. Spontaneous healing is associated with tissue bacterial counts of less than 10^5 organisms per gram of tissue. Increased amount of oxygen supply to neutrophils results in oxidative bursts that kill microbes.⁸ Oxygenation eliminates anaerobic organisms which have been correlated to decrease healing rate.⁹NPWT is a new technology with multiple indications in a variety of wounds including pressure sores, amputation sites, skin grafts, burns, lower limb ulcerations. The results demonstrate that patients who have undergone treatment with negative pressure wound therapy presented quick healing of the wound than patients who have undergone silver stream dressing. Thus, NPWT showed an resulted in rapid wound healing, short hospital stay and improved quality of life.

CONCLUSION

NPWT is used in a wide variety of wounds with promising results. It scores over conventional dressings in rapid resolution of the wound, reduced antibiotic requirement and short hospital stay.

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