



COMPARATIVE STUDY OF EFFICACY OF NEGATIVE PRESSURE WOUND THERAPY VERSUS CONVENTIONAL DRESSING IN OPEN WOUNDS

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ABSTRACT

Introduction: Several treatment methods have been utilized to improve wound healing process. These include various medical dressings, surgical debridement, topical applications and antiseptic medication. Negative pressure wound therapy is a relatively newer treatment modality. Aim of the present study is to compare the efficacy of negative pressure wound therapy (NPWT) and saline moist gauze dressing in patients admitted with open wounds.

Materials and Methods: This is a prospective comparative study conducted on 104 patients with open wounds of various aetiologies between October 2014 to April 2016. The patients were divided into two groups each group comprising of 52 patients. One group received negative pressure wound dressing while the other group received saline moist gauze dressing. Data entry and statistical analysis were performed using the Microsoft Excel. Values were represented in number, percentage, Mean \pm SD and Tests of significance were applied.

Results: Maximum number of patients had diabetic aetiology followed by necrotizing fasciitis/infective aetiology. Granulation tissue formation to be significantly earlier in NPWT group as compared to other group. Wound closure time was also achieved nearly 1.5 times faster in NPWT as compared to control group. Compared NPWT with saline wet-moist gauze and found this difference to be significant.

Conclusions: Negative pressure wound therapy can be considered as a better option in the management of open wounds.

Keywords: Negative pressure wound therapy, moist gauze, wound healing

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INTRODUCTION

Chronic wounds, especially of the non-healing types, are one of the most common surgical conditions a surgeon comes across. Whatever the management given, chronic wounds, especially pressure ulcers or bed sores refuse to heal. The issue of chronic wound management still remains an enigmatic challenge. Empirically, the ancient physicians of Egypt, Greece, India and Europe developed gentle methods of treating wounds by removing foreign bodies, suturing, covering wounds with clean materials and protecting injured tissue from corrosive agents.¹ During the last two decades a wide variety of innovative dressings have been

introduced. Acute and chronic open wounds affect at least 1% of the population. These wounds may heal or may result in hospitalization, amputation, sepsis and even death.² Wound healing is a complex and dynamic process of replacing devitalized and missing cellular structures and tissue layers. The human adult wound healing process can be divided into 3 or 4 distinct phases. The process was defined to be having 3 phases – inflammatory, fibroblastic, and maturation³ and was also been denoted as inflammatory, proliferation, and remodeling.^{4,5} It was refined in later years to be a 4-phases concept, which was the haemostasis phase, the inflammatory phase, the

proliferation phase, and the remodelling phase.⁶ In the 3-phases approach, the haemostasis phase was contained within the inflammatory phase. Separate parts of a wound may be at different stages of healing at any one time.⁷⁻¹⁰ Several treatment methods have been utilized to improve wound healing process. These include various medical dressings, surgical debridement, topical applications and antiseptic medication.^{11,12} Most recent of these methods is Negative Pressure Wound Therapy (NPWT) developed in the early 1990.^{13,14} We, therefore, set out to compare the efficacy of negative pressure wound therapy and saline moist gauze dressing in patients admitted with open wounds.

MATERIAL AND METHODS

The study was conducted between October 2014 to April 2016. The source of data was patients admitted to the indoor patient care unit of Department of General Surgery of Era’s Lucknow Medical College, Lucknow for the management of wounds. The sample size was 104 cases. The study group A consisted of 52 patients who received negative pressure dressing. The group B consisted of 52 patients who received conventional moist dressings.

Inclusion Criteria

- Patients with acute large wounds (≥ 5 cm in shortest length)
- Patients with chronic, non-healing wounds (≥ 1 month duration, ≥ 3 cm in shortest length)

Exclusion Criteria

- Patients with untreated osteomyelitis, Non-enteric and unexplored fistulas, Malignancy in the wound, Exposed vasculature, Exposed nerves, Exposed anastomotic site, Exposed organs
- Patients who did not conform with given treatment
- Age <15 and >75 years
- HIV/HCV/HBsAg positive patients
- Multiple wounds
- Patients receiving Chemotherapy or Radiotherapy
- Moribund patient

- Patient who changed management due to non-medical reasons, patients not completing the prescribed treatment

A predesigned form was used to record the data. Careful history was taken to determine any etiological factors and history of steroid intake or others factors for non-healing wounds. Examination of the wounds was for size (area in centimetre square), depth (in millimetre), presence or absence of dead/devitalized tissue and foreign body, signs of infection and presence or absence of granulation tissue were taken. Also data was collected by recording details of the onset of the wound, progress of the wound and its characteristics with respect to appearance of granulation tissue and percentage of increase along with demographic details. Prior written and informed consent was taken.

STATISTICAL ANALYSIS

Data entry and statistical analysis were performed using the Microsoft Excel. The values were represented in number, percentage, mean and standard deviation. Tests of significance were applied to find out the results. Statistical significance taken p value < 0.05.

RESULTS

The 104 patients admitted for the study were divided into two equal and comparable groups. Out of these 104 patients, 52 (50.0%) were subjected to Negative Pressure wound therapy were classified as Group A, and rest 52 (50.0%) were subjected to Saline wet gauze dressing were classified as Group B.(table 1)

Table 1: Distribution of study population

Group	Description	No. of patients	Percentage
Group A	Negative Pressure wound therapy	52	50.00
Group B	Saline wet gauze dressing	52	50.00
Total		104	100.00

Though proportion of patients was higher in Group A as compared to Group B with Diabetic (51.92% vs. 42.31%) and traumatic (15.38% vs. 11.54%) aetiology while proportion of patients in Group B was higher as compared to Group A for necrotising fasciitis/infective (28.85% vs. 21.15%) and pressure

sore (17.31% vs. 11.54%), but difference in aetiology of patients of Group A and Group B was not found to be statistically significant (p=0.570).(table 2)

Table 2: Group wise comparison of wound aetiology

Variables	Total	Group A (n=52)		Group B (n=52)		Statistical significance	
		No.	%	No.	%	χ^2	p
Diabetic	49	27	51.92	22	42.31	2.01	0.570
Necrotising Fasciitis/Infective	26	11	21.15	15	28.85		
Pressure sore	15	6	11.54	9	17.31		
Traumatic	14	8	15.38	6	11.54		

Table 3 shows that the mean wound size of Group A (163.28±103.57 cm²) was found to be higher than that of Group B (151.67±88.50 cm²) but this difference was not found to be statistically significant (p=0.540). Though depth of wound of Group A (13.37±6.05 mm) was found to be higher than that of Group B (13.21±5.90 mm) but this difference was not found to be statistically significant (p=0.896).

Table 3: Group wise comparison of wound size (area) and depth of wounds at presentation

Variables	Group	Mean± SD	P- Value
Wound size (cm ²)	Group A	163.28±103.57	't'=0.614; p=0.540
	Group B	151.67±88.50	
	Total	157.48±96.04	
Depth of wound (mm)	Group A	13.37±6.05	't'=0.131; p=0.896
	Group B	13.21±5.90	
	Total	13.29±5.94	

Granulation appearance was statistically significantly earlier in Group A (8.35±2.79 days) as compared to Group B (12.52±6.40 days). Wound closure in Group A (23.69±6.52 days) was statistically significantly earlier than in Group B (34.33±10.21 days). Duration of hospital stay in Group A (28.25±6.94 days) was short as compared to that in Group B (39.17±10.36 days), difference in duration of hospital among patients of Group A and Group B was found to be statistically significant. (table 4)

Table 4: Group wise comparison of duration of appearance of granulation, wound closure and hospital stay

Variables	Group A (n=52)		Group B (n=52)		Independent 't' test	
	Mean	SD	Mean	SD	't'	'p'
Appearance of granulation (Days)	8.35	2.79	12.52	6.40	-4.310	<0.001
Wound closure	23.6	6.52	34.3	10.21	-	<0.001

(Days)	9	52	3	21	6.329	1
Hospital Stay (Days)	28.2	6.94	39.1	10.36	-	<0.001

Table 5 illustrates that the difference in wound depth before treatment among patients of Group A (13.37±6.05 mm) and Group B (13.21±5.90 mm) was not found to be statistically significant (p=0.896). Difference in wound depth after treatment among patients of Group A (6.13±4.02 mm) and Group B (5.71±4.05 mm) was not found to be statistically significant (p=0.896). Mean reduction in wound depth was 56.86±21.62% in Group A while that in Group B was 58.66±24.54%. Difference in mean reduction in wound depth between Group A and Group B was not found to be statistically significant (p=0.692).(table 5)

Table 5: Group wise comparison of change in wound size and depth

Variables	Group A (n=52)		Group B (n=52)		Independent 't' test	
	Mean	SD	Mean	SD	't'	'p'
Reduction in Wound size (%)	45.92	5.42	24.07	10.73	13.111	<0.001
Reduction in Wound depth (%)	56.86	21.62	58.66	24.54	-0.397	0.692
Duration of wound closure (days)	23.69	6.52	34.33	10.21	-6.329	<0.001

DISCUSSION

The concept of moist wound dressings which came into vogue in the 1960s revolutionized wound care.¹⁵ Hydrocolloid dressings remain popular even today. In the early 1990s, the concept of topical negative pressure moist wound dressing was introduced into the field of chronic wound care. This type of dressing involved a combination of hydrocolloid dressings with topical negative pressure dressings.¹⁶ The concept of applying a sub-atmospheric environment on wounds to accelerate the healing process came into practice in 1993 and was first described by Fleischmann et al.¹⁷ In present study, maximum number of patients had diabetic aetiology followed by necrotizing fasciitis/infective aetiology. The high prevalence of wounds with diabetic aetiology could be attributed to the chronic nature of diabetic wounds. In various studies that included chronic wounds in their study, diabetic aetiology is one of the major contributor.¹⁸⁻

²¹ Statistically the granulation, wound closure and hospital stay durations were significantly shorter in NPWT group as compared to saline group. The findings of study support the view point of Voinchet and Magalon. ²² In present study, granulation tissue formation to be significantly earlier in NPWT group as compared to saline group. However, Braakenburg *et al.* ¹⁸ did not find the granulation to be faster in NPWT as compared to control group in overall assessment. In several other studies the rate of granulation has been found to be faster in NPWT group as compared to control group as observed in present study ²³⁻²⁵. In various studies from India too, NPWT has shown a faster granulation as compared to control group ²⁶⁻²⁸. In present study, wound closure time was also achieved nearly 1.5 times faster in NPWT as compared to control group, thus showing that the rate of granulation corresponded with wound closure too. Although, Braakenburg *et al.* ¹⁸ did not find a significant difference in wound healing time between NPWT and control group, Blume *et al.* ²⁹ found wound healing to be 1.52 times faster in NPWT as compared to control group while McCallon *et al.* ³⁰ found it to be 1.87 times faster. Other researchers also found wound healing time to be 1.5 to 2 times faster in NPWT as compared to control group. ³¹⁻³⁴ In different studies from India too, wound healing time was reported to be faster in NPWT as compared to control group. In a study comparing NPWT with saline wet-to-moist gauze group, as done in present study, Sinha *et al.* ²⁸ reported the decrease in wound size to be almost 4 times larger in NPWT group as compared to control group. Ford *et al.* ³⁵ while comparing NPWT and Health point System (HP) wound gel found reduction in ulcer volume to be higher in NPWT group as compared to HP group but did not find this difference to be significant. In present study, compared NPWT with saline wet-moist gauze and found this difference to be significant. Eginton *et al.* ³⁶ on the other hand, in a two week assessment reported reduction in wound volume to be 59% and 0% respectively for NPWT and moist gauze dressings. However, in present study we did not achieve these extreme results yet were able to find a substantial difference between NPWT and control groups. Present study show that negative pressure wound therapy is a useful

modality in management of all types of wounds including the chronic wounds.

CONCLUSION

Negative pressure dressing was found to be totally safe, although technically demanding, by virtue of one time application of dressing. Thus, negative pressure moist wound dressing can be considered as a advanced option in the management of chronic wounds. however further studies with a larger population will be needed in the future prior to negative pressure dressing can be added to the wide spectrum of treatment modalities available in the management of chronic wounds.

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