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EFFECTIVENESS OF NEGATIVE PRESSURE DRESSING IN CHRONIC WOUNDS

Surgery

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ABSTRACT

Introduction: Negative pressure wound therapy is a wound healing therapy that utilizes a dressing system that continuously or intermittently applies a negative pressure to the wound surface. It can be used in the management of both acute and chronic wounds and complex wounds such as burn wounds. Very few studies conducted in Maharashtra regarding study of effectiveness of negative pressure dressing in chronic wounds at tertiary care center. So, this study was conducted to compare the efficacy of healing process of chronic ulcers treated by negative pressure dressing with conventional methods of dressing. **Methods:** This was a prospective observational study conducted among all patients with chronic ulcer of size >10 cm & aged >18 years admitted to Surgery department of tertiary care centre during a period of two years from Dec 2020 to Nov 2022. **Results:** Total 80 cases were enrolled in this study. There was significantly reduced in size of wound as duration increases when treated NPWT. Duration of hospital stay was significantly lower among NPWT compare to conventional. Culture conversion rate was significantly higher when treated with NPWT compare to conventional. Also the >50 % appearance of granulation tissue was significantly more among NPWT. **Conclusion:** From this study we conclude that, effectiveness of negative pressure dressing in chronic wounds, our findings suggest that the negative pressure wound dressing shows better outcome than conventional dressing.

KEYWORDS

Chronic ulcer, NPWT, Conventional method

INTRODUCTION

Negative pressure wound therapy is a wound healing therapy that utilizes a dressing system that continuously or intermittently applies a negative pressure to the wound surface. It can be used in the management of both acute and chronic wounds and complex wounds such as burn wounds. NPWT stimulates wound healing through two processes called macrostrain & microstrain. Macrostrain draws the edges of the wound together equally distributes the negative pressure and removes exudates and infectious materials. Microstrain reduces edema stimulates perfusion and stimulates granulation tissue formation. The practice to expose a wound to negative atmospheric pressure for a long period of time in order to promote wound healing was first described by Fleischmann et al. in 1993 (1).

Vacuum-assisted closure (VAC) therapy is a sophisticated system that produces a humid, closed, sterile and isolated environment (1–3). The negative pressure accelerates the healing process by removing exudates, reducing bacterial load, increasing the growth of granulation tissue, favouring the contraction of the lesion margins, and promoting angiogenesis (4–6). VAC therapy is applied in many fields: traumatic and dehiscent surgical wounds, acute and chronic wounds, partial-thickness burns (grade I and II), sternal osteomyelitis (7–9) and mediastinitis (10–16). There are few published articles regarding the use of VAC therapy on infected wounds. Infection is considered one of the contraindications to negative pressure wound therapy (NPWT) (17). This contraindication is related to the possibility of promoting bacterial growth as a result of leaving the VAC dressing on the bed of an infected wound for several days.

In a recent study, Yang SL et al. (18) highlighted, by immuno-histochemical and western blot analysis, a greater expression of basic fibroblast growth factor(bFGF) and ERK 1/2 (extracellular signal-regulated kinase) in a group of patients with diabetic foot ulcers treated with VAC therapy compared with the control group treated with traditional dressings. Several studies show an increase in the rate of formation of granulation tissue richly vascularised and an increase of capillary bed at the site of application of the NPWT.

Very few studies conducted in Maharashtra regarding study of effectiveness of negative pressure dressing in chronic wounds at tertiary care center. So, this study was conducted to compare the efficacy of healing process of chronic ulcers treated by negative pressure dressing with conventional methods of dressing.

MATERIAL & METHOD

This was a prospective observational study conducted among all patients with chronic ulcer of size >10 cm & aged >18 years admitted to Surgery department of tertiary care centre during a period of two years from Dec 2020 to Nov 2022. Patients having wound with pathological fracture, ulcer size <10 cm & not willing for Topical negative pressure dressing were excluded.

Sample size was calculated using formula; Sample size = 2* [Z (alfa) + Z(1-beta)]2 * P *Q/ (P1-P2)^2. Where P1 = clinically anticipated prevalence of complete recovery for negative pressure Dressing = 75 % P2= Clinically anticipated prevalence of complete recovery conventional Dressing = 65% P= p1 +p2 / 2 = 70 % Q= 1 - P Level of significance (alfa error) = 5 % (0.05) Power of test = 80% (0.84). Calculated sample size was 80.

All patients were included by convenient sampling technique after taking consent. Data was collected with predesigned and pretested questionnaire. Questionnaires included general information, such as age, sex, medical history- chief complain, past history, general examination, systemic examination. A detailed study of clinical history and examination of chronic ulcer, site, associated comorbidities, red granulation growth, recovery rate. Randomly 40 cases were treated with negative pressure & 40 cases were treated with conventional dressing.

The data were entered in Microsoft Excel and data analysis was done by using SPSS demo version no 21 for windows. The analysis was performed by using percentages in frequency tables and correlation of negative pressure dressing with various risk factors, compare the efficacy of healing process of chronic ulcers treated by negative pressure dressing with conventional methods of dressing. P <0.05 was considered as level of significance using the Chi square test.

RESULTS

Total 80 cases enrolled in this study, majority of cases were found in 46-60 years age group 17 (42.5%) followed by >60 years age group 12 (30%) who were treated with NPWT& among cases treated with conventional method majority of cases were found in 46-60 years age group 15 (37.5%) followed by >60 years age group 13 (32.5%). Majority were male patients. Most common etiology was diabetes. (Table1)

Table 1: Distribution Of Patients According To Clinic-social Profile

Parameter	NPWT		Conventional	
	Frequency	Percentage	Frequency	Percentage

Age Group (Years)	18-30	3	7.5	2	5
	31-45	8	20	10	25
	46-60	17	42.5	15	37.5
	>60	12	30	13	32.5
Gender	Male	27	67.5	25	62.5
	Female	13	32.5	15	37.5
Etiology	Diabetic	22	7.5	18	45
	Ischemic	3	25	4	10
	Traumatic	10	12	14	35
	Other	5	5	4	10
Size of wound (cm)	10-15	10	25	9	22.5
	15-20	16	40	18	45
	>20	14	35	13	32.5

Table 2: Association Between Clinical Outcome & Method Of Treatment

Size of wound (cm)		Conventional			NPWT			p
		0-10 mm	10-20 mm	>20 mm	0-10 mm	10-20 mm	>20 mm	
Duration of ulcer	Baseline	0	0	0	0	0	0	0.042
	Day 5	10	1	0	18	7	1	
	Day 10	16	3	0	10	22	8	
	Day 15	27	13	0	0	22	18	
Duration of hospital stay (Days)	15-20	9			35			0. 00001
	21-30	13			5			
	>30	18			0			
Culture positive	Before	40			40			0. 00005
	After	30			12			
Appearance of granulation tissue	<50%	0			0			0. 0002
	>50%	28			40			

There was significantly reduced in size of wound as duration increases when treated NPWT. Duration of hospital stay was significantly lower among NPWT compare to conventional. Culture conversion rate was significantly higher when treated with NPWT compare to conventional. Also the >50 % appearance of granulation tissue was significantly more among NPWT. (Table 2)

DISCUSSION

Prospective observational study conducted in surgery department of tertiary care center with all cases of chronic ulcer admitted in surgery department during study period such cases were included in the study.

VAC therapy has become widely used in the medical and surgical fields, and it is indicated for various types of pathology. The mechanisms by which VAC therapy promotes wounds healing are diverse: it removes exudates, reduces bacterial load, increases the growth of granulation tissue, favours the contraction of the lesion margins and promotes angiogenesis By inducing the contraction and the approximation of lesion margins, the NPWT applies a mechanical stress to the tissues causing cell micro deformation that facilitates cell division and proliferation [19].

There are many indications for VAC therapy, a number of contraindications exist, such as osteomyelitis that has not treated surgically; active sepsis, coagulopathies, Marjolin ulcers, allergies to one of the components required for NPWT treatment, fistulae that have not been explored, treatment with anticoagulants, wounds with exposed blood vessels, nerves or vital organs and the presence of necrotic tissue within the wound. Besides these hard clinical contraindications, there are also some relative contraindications.

Falling into this category is the use of VAC therapy in grossly infected wounds. Hesitation to accept the use of NPWT for grossly infected wounds stems from the nature of NPWT dressings, in that they stay on for a prolonged period of time, and the risk of bacterial proliferation may be increased. Currently, there is no quality evidence in the literature that validates the use of NPWT in the course of infection or not [17]

NPWT likely induces an increase in the concentration of local antibiotic through two different mechanisms. The first is the removal of excess exudate. NPWT reduces the mechanical obstruction to blood flow in tissues, thus promoting the delivery of antibiotics and white blood cells. The second mechanism is the induction of increased amounts of granulation tissue, which is richly vascularised tissue.

1) In current study in NPWT group majority of cases were found in 46-60 years age group 17 (42.5%) followed by >60 years age group 12 (30%), 31-45 years age group 8 cases (20%) and 3 cases found in the 18-30 years age group and in Conventional majority of cases were found in 46-60 years age group 15 (37.5%) followed by >60 years age group 13 (32.5%), 31-45 years age group 10 cases (25%) and 2 cases found in the 18-30 years age group. Similar finding observed in the study of Patmo AS et a l[17] he reported that the majority of cases from above 40 years age group. Similar result reported by Kundu A et al [20] he reported that the with age of patients ranging from 15 years to 67 years, mean being 37.7 years
2) In present study majority of VAC group cases were males contributing 27 (67.5%) and females 13 (32.5%) and majority of conventional group cases were males contributing 25 (62.5%) and females 15 (37.5%).Similar result reported by Kundu A et al [20] he reported that the most of cases were male There were 21 male patients and four female patients.
3) In current study majority of VAC group cases etiology was diabetic 22 (55%) followed by traumatic 10 (25%) Other 5 (12.5%) and 3 cases found with ischemic (7.5%). Most of Conventional group cases etiology was diabetic 18 (45%) followed by traumatic 14 (35%) Other 4 (10%) and 4 cases found with ischemic (10%). Similar result observed in the study of Saxena V, et al [19] He reported that the most common etiology was diabetic followed by trauma.
4) In current study majority of Conventional group cases wound size were 15-20 cm 18 followed by 13 cases presented with >20 cm and 9 cases with 10-15 cm. NPWT most of cases with 15-20 cm size 16, >20 cm with 14 cases and 10 cases with 10-15cm size. Similar result found in the study of Kundu A et al [20] he reported that the most of cases presented with 15-20 cm wound size.
5) In current study conventional group on Day 15 wound size reduction 0-10mm found in 27 cases and 13 cases with 10-20mm size reduction. In NPWT group on Day 15 size reduction 10-20mm found in 22 cases and 18 cases with >20mm wound size reduction. The comparison between NPWT v/s Conventional dressing wound size reduction was significant at p<.05. Similar result found in the study of Kundu A et al [20] he reported that the15 wounds showed mean decrease of 0-10 mm (60%), 32% (8 wounds) showed mean decrease between 10 20 mm and rest 2 (08%) wounds showed reduction more than 2 cm. Another study conducted by Sinha et al [21] found in their study a decrease in size of 10 to 19.9 mm in 46.66% of patients of NPWT group and only 6.66% in control group. A decrease in size of more than 25 mm was seen in 13.33% in NPWT group. Ford et al [22] found 42.1% reduction in wound volume in diabetic foot ulcers.
6) In present study conventional group 9 cases hospital stay was 15-20 days and in NPWT group 35 cases hospital stay was 15-20 days. Comparison of duration in hospital stay in conventional v/s NPWT was statistically significant at p <0.05. Similar result reported in the study of Liu D et al [23] he reported that duration in hospital stay in conventional v/s NPWT was statistically significant at p<.05.
7) In current study conventional group 30 cases culture positive for bacteria and in NPWT 12 cases were culture positive. Comparison of bacterial culture positive in conventional v/s PNWT statistically significant at p<0.05.
   Contrast result reported in the study of Liu D et al [23] he reported that the Comparison of bacterial culture positive in conventional v/s NPWT statistically significant at p<.05
8) In current study conventional group 28 cases shows granulation tissue and in NPWT group all 40 cases shows granulation tissue. Comparison of appearance of granulation tissue in conventional v/s NPWT was statistically significant at p <0.05. Similar result found in the study of Moss et al granulation tissue appeared in 26 (92.85%) patients by the end of week 2 in NPWT group in contrast to 15 (53.57%) patients by that time in conventional group.

CONCLUSION

From this study we conclude that, effectiveness of negative pressure dressing in chronic wounds, our findings suggest that the negative pressure wound dressing shows better outcome than conventional dressing. The wound size reduction and formation of granulation tissue in negative pressure wound therapy is dominating over normal conventional dressing group. Hospital stay of patients are significantly reduced in the NPWT group. The bacterial load also significantly reduced in NPWT group as per culture and sensitivity reports. Wound healing is faster with negative pressure wound dressing and show

better efficacy as compared with conventional method.

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