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EFFICACY OF NEGATIVE PRESSURE WOUND THERAPY IN OPEN WOUNDS: A PROSPECTIVE STUDY

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ABSTRACT

Introduction: 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. One of the most significant discoveries in wound management is the improvement of wounds with negative pressure wound therapy (NPWT). In this study, the efficacy of negative pressure dressing was assessed in wound healing.

Materials and Methods: Fifty-two patients were included in the study who admitted in indoor patient care unit of Department of General Surgery of the Era's Lucknow Medical College, Lucknow during the period October 2014 to April 2016 fulfilling all the inclusion criteria. Data entry and descriptive analysis were performed using the Microsoft Excel.

Results: Mean age of patients was 38.32±12.32 years. Majority of patients were within 40 years of age (58.7%). Majority were males (71.15%). Hundred percentage wounds presented with dead/devitalized tissue. Culture positivity and pus discharge were seen in 98.08% and 90.38% cases respectively. Random blood sugar showed maximum variation in the observed values among rest of the Hematological/Biochemical Variables. Recurrence/persistence of infection rate was 44.23%, % Reduction in wound size and wound depth was 45.92±5.42 and 56.82±21.62.

Conclusion: NPWT therapy is a useful choice for treatment of wounds when compared to other treatments in terms of reduction in wound size.

Keywords: Negative pressure, wound therapy, wound size, indoor patient

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INTRODUCTION

Wound dressings developed very slight for many years until 1867, when Lister introduced antiseptic dressings by soaking lint and gauze in carbolic acid. Meanwhile then, numerous more sophisticated products have become available. Wound healing is most successful in moist, clean and warm atmosphere. Studies have demonstrated that the rate of epithelialization under a moist occlusive dressing is twice that of a wound that is left uncovered and allowed to dry. An occlusive dressing provides a mildly acidic pH and low oxygen tension on the wound surface which is conducive for fibroblast proliferation and formation of granulation tissue. However, wounds that produce significant amounts of exudate or have high bacterial counts require a dressing that is absorptive and prevents maceration of the surrounding skin.[1,2] These dressings also need to reduce the bacterial load while absorbing the exudate produced. One of the most significant discoveries in wound management in recent decades is the improvement in wounds with negative pressure wound therapy. This modality has many uses and has found its way into the armamentarium of a wide array of surgical and nonsurgical specialties. It should best be thought as an adjunct to assist in surgical closure of a problem wound. [3] Earlier the most common modality of treatment was

conventional wound dressing. But recent studies have shown that application of a sub atmospheric pressure in controlled manner to the wound site has got an important role in assisting wound healing. Negative pressure wound dressing is a new technology that has been shown to accelerate granulation tissue growth and promote faster healing, thereby decreasing the period between debridement and definite surgical closure in large wounds. Vacuum-assisted wound closure (VAC) is a wound management technique that exposes wound bed to negative pressure and provides a moist wound-healing environment. This technique has been developed and popularized world-wide by Prof. Louis Argenta [2] and Prof. Micheal Moryk was [4] from the USA and by Dr Win Flies chmann from Germany.[5] Wound and their management are fundamental to the practice of surgery. Dressings are applications for wounds to provide the ideal environment for wound healing. Many studies have been conducted comparing various dressing modalities for different types of wounds. [6,7] In this study, the efficacy of negative pressure dressing was assessed in wound healing.

MATERIAL AND METHODS

This prospective study included 52 patients with chronic wounds of varying aetiology, admitted to the indoor patient care unit of Department of General Surgery of Era's Lucknow Medical College, Lucknow, from October 2014 to April 2016 satisfying all the inclusion criteria mentioned below after the clearance from the ethical committee was obtained. The main inclusion criteria were (a) Patients with acute large wounds (≥ 5 cm in shortest length) (b) Patients with chronic, non-healing wounds (≥ 1 month duration, ≥ 3 cm in shortest length) and (c) Patients giving consent for topical negative pressure dressings. The main exclusion criteria for the study included (a) Patients with untreated osteomyelitis, Non-enteric and unexplored fistulas, Malignancy in the wound, Exposed vasculature, Exposed nerves, Exposed anastigmatic site, exposed organs (b) Age less than 15 years and more than 75 years. (c) HCV/HBsAg positive patients (d) Multiple wounds (e) Patients receiving Chemotherapy or Radiotherapy (f) Moribund patient (g) 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.

Statistical analysis

Data entry and descriptive analysis were performed using the Microsoft Excel. The values were represented in number, percentage, mean and standard deviation.

RESULTS

The present study was conducted in the Department of Surgery, Era's Lucknow Medical College & Hospital, and Lucknow to evaluate the efficacy of "Negative Pressure Wound Therapy". A total of 52 patients aged 19-75 years with chronic, non-healing wounds (≥1-month duration, ≥ 3 cm in shortest length) or with acute large wounds (≥ 5 cm in shortest length) were included in the study.

Table 1: Distribution of respondents according to their demographic characteristics

Variables	Frequency	
	No.	%
Age Group		
Upto 20	0	0.00
21-30	22	42.31
31-40	10	19.23
41-50	11	21.15
51-60	4	7.69
61-70	5	9.62
Mean±SD	38.40±12.64	
Gender		
Female	15	28.85
Male	37	71.15
Male: Female	1:0.41	

Table 1 depicts that the distribution age – gender od the study subjects. In which, Age of patients ranged between 19 and 69 and mean age was 38.32+12.32 years Majority of subjects were belongs to age

group 21-30 years. Admission of subjects were decreases as the age group increases .Out of 52 patients, only 15 (28.85%) were females and 37 (71.15%) males. Male : Female ratio was 1:0.41

Table 2: Distribution of respondents according to their Condition of Wound

Variables	Frequency	
	No.	%
Exposed Bone	27	51.92
Dead/ Devitalized tissue	52	100.00
Pus Discharge	47	90.38
Granulation	0	0.00
Culture positive	51	98.08

Table 2 illustrates that the distribution of respondents according to their Condition of Wound. Proportion of patients with Dead/ Devitalized tissue was higher as compared to other categories. In all the patients, granulation was found in none of the patients. In all the patients, mode of intervention was debridement. Fifty-one patients showed culture positive. Followed by condition of wound Pus Discharge i.e., (90.38%)

Table 3: Distribution of respondents according to their Haematological/Biochemical Variables

Variables	Mean	SD
Hb (g/dl)	11.12	1.74
RBS (mg/dl)	154.85	51.54
FBS (mg/dl)	167.17	33.68
BS_PP (mg/dl)	257.10	49.29
HbA1c (%)	8.07	0.71
Total protein (g/dl)	7.24	0.56
Serum albumin (g/dl)	3.66	0.29

Table 3 shows that the mean and standard deviation of Haematological/Biochemical Variables of respondents. Mean value of BS_PP (mg/dl) was highest among rest of the Haematological/Biochemical Variables. Followed by FBS (167.17mg/dl). Average haemoglobin level of respondents was 11.12 g/dl. Mean percentage of HbA1c was 8.07%. Serum albumin (g/dl) showed minimum mean value i.e., (3.66g/dl) . RBS (mg/dl) showed maximum variation in the observed values.

Table 4: Distribution of respondents according to Recurrence

Variables	Frequency	
	No.	%
No recurrence, persistent, infection	29	55.77
Recurrence/ Persistent/ Infection	23	44.23

Table 4 shows that the percentage distribution of respondents according to Recurrence. In which, observed that majority of the study subjects hadn't recurrence, infection or persistence of wound, which was found 29 (55.77%). Proportion of patients with no recurrence was higher as compared to Recurrence/ Persistent/ Infection. 44.23% of study subjects had Recurrence/ Persistent/ Infection.

Table 5: Distribution of respondents according to their Size & Depth of wound and Reduction after treatment

Variables	Before Treatment		After treatment		% Reduction after treatment	
	Mean	SD	Mean	SD	Mean	SD
Size of wound	170.46	107.52	91.50	58.10	45.92	5.42
Depth of wound	13.37	6.05	6.13	4.02	56.86	21.62

Above table depicts that the distribution of respondents according to their Size & Depth of wound and percentage of Reduction after treatment. Observed that before treatment size of wound of study subjects was (170.46+107.52 cm^2). After treatment mean size of wound was (91.50+58.10 cm2). Mean reduction in size of wound (decline) was 45.92+5.42%. Whereas, wound depth before treatment among study subjects was (13.37+6.05 mm). Wound depth after treatment among study subjects was (6.13+4.02 mm). Mean reduction in wound depth was 56.86+21.62%.

DISCUSSION

Negative pressure wound therapy (NPWT) has played a major role as a bridge to reconstruction. It is a significant, clinically proven advancement in wound care that promotes active wound healing at the cellular level through negative pressure. [4,8] systematic reviews have confirmed its consistency and benefits for some specific types of wounds. [9] However, there is still debate whether NPWT provides benefits in all types of wounds. [10] In India, some of the clinical trials evaluating role of NPWT in various types of wounds have shown a promising response. [11-14] Considering these positive responses for NPWT in these studies, the present study was carried out with an aim to assess the efficacy of negative pressure wound therapy. Finally, age of patients ranged from 19 to 69 years with a mean age of 38.32±12.32 years. Majority of patients were

within 40 years of age (58.7%). Wounds are not age-barred, they can occur in any age. Most of the studies on treatment of wounds have included patients with diversified age groups. McCallon et al. (2000) [15] in their study included patients aged 18 to 75 years whereas in the study of Moisidis et al. (2004) [16] in their study included patients aged 27 to 88 years. But researchers like Svensson et al. [17] had an extraordinarily high age of patients in their study with median age 75 years. As a matter of fact, age has a definitive impact on wound healing.[18-21] In present study, majority of patients were males (71.15%). Male to female ratio was 1:041. As such, there is no systematic study available evaluating the effect of gender on wound occurrence in general, however, some epidemiological studies on chronic wounds indicate a higher crude prevalence rate among women as compared to men. [22] At appearance all the patients' wounds presented with dead/devitalized tissue (100%). Culture positivity and pus discharge were seen in 98.08% and 90.38% cases respectively. In present study, mean value of BS_PP (mg/dl) was highest among rest of the Haematological/Biochemical Variables. Mean percentage of HbA1c was 8.07%. Serum albumin (g/dl) showed minimum mean value i.e., (3.66g/dl) . RBS (mg/dl) showed maximum variation in the observed values. In addition, Glycaemic control, hemodynamic, serum protein levels, systemic status have been suggested to play a role in wound healing.[18,23,24] In present study, recurrence/persistent infection was seen in 44.23% of NPWT. NPWT has been reported to have a superior infection control as compared to conservative management of wounds. Stannard et al. [25] in their study showed infection rate to be half in NPWT group as compared to pressure dressing group. In a study from India, Siddha et al. [14] also showed infection clearance rate to be almost double in NPWT as compared to conventional betadine dressing. In present study, in terms of percentage reduction in wound size it was 45.92±5.42% in NPWT group. NPWT has shown a greater wound size reduction as compared to other treatment modalities in different studies.[26,27] Mouës et al. [28] in another study reported mean reduction in sound surface area to be 3.8%/day for NPWT as compared to 1.7%/day for conventional-treated wounds. Thus, present study showed that the NPWT dressing can be considered as a superior option in the management of chronic wounds Furthermore, Page et al. [29] conducted a retrospective analysis of negative pressure wound therapy in open foot wounds with significant soft tissue defect and concluded that negative pressure wound therapy reduced the risk of complications, subsequent foot surgeries and hospital readmissions by 70% or more. In a study conducted by Weed et al [30] concluded that NPWT has become an accepted treatment modality for acute and chronic wounds.

CONCLUSION

On the basis of findings of present study, it can be concluded that negative pressure wound therapy is a useful choice for treatment of wounds when compared to other treatments in terms of reduction in wound size. Further studies on a larger number of sample size including both chronic and acute wounds are recommended to evaluate the treatment response under variable wound types.

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