ORIGINAL RESEARCH PAPER

General Surgery

COMPARATIVE STUDY OF MODIFIED VACUUM ASSISTED CLOSURE DRESSING AND CONVENTIONAL DRESSING FOR SPLIT SKIN GRAFTING WOUND BED PREPARATION IN A TERTIARY CARE CENTER, CHENGALPATTU DISTRICT

KEY WORDS:

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ABSTRACT

Background: Management of the wound is a challenging process. Many conventional techniques have been used so far for wound management yet desired results are not achieved. A newer technique which is cost effective and safer has come into the play that gives better results. **Aim:** The aim of this study is the evaluate the efficacy of the negative pressure wound therapy in wound management in low resource setting. **Objective:** To find out the effectiveness of vacuum assisted dressing on wound management by measuring graft uptake, wound healing time, need for re-grafting and hospital stay. **Materials and Method:** In this prospective randomized comparative study, totally 52 cases were taken and divided into two groups randomly by lottery method as control group with 26 cases for conventional papain-urea ointment in combination with amorphous hydrogel colloidal silver gel dressing and as interventional group of 26 cases with modified vacuum assisted dressing. All wounds were initially subjected to thorough debridement. Wound bed preparation for SSG was achieved within 3-4 sets of vacuum dressing. Until regular conventional dressing done in control group. All the patients subsequently treated with SSG. Outcome was measured and results are compared. **Results:** Vacuum assisted dressing found to have sterile wound ,reduced hospital stay, earlier decrease in wound size, good graft uptake, deceased complication and cost effective. **Conclusion:** Vacuum assisted dressing proven to be effective than conventional method for wound bed preparation in SSG.

INTRODUCTION

Management of the wound is a challenging process. Many conventional techniques have been used so far for wound management yet desired results are not achieved. A newer technique which is cost effective and safer has come into the play that gives better results. Thus, vacuum assisted closure dressing is the recent trend used for faster and better wound healing.The basic concept with this new trending technique is that it keeps the wound dry since the serous or any bloody discharge which acts as the medium for the growth of organism will be removed due to negative pressure suction and promotes the wound healing by changing the microvascular environment and keeps the wound microorganism free. The negative pressure that will be applied will be between -75mmHg to -200mmHg. Thus, this vacuum dressing is done till the granulation tissue appears in the wound and closure of the wound done by secondary healing, secondary suturing, split skin grafting, flap repair.

OBJECTIVES:

To assess and to compare the efficacy of the negative pressure wound therapy and conventional dressing in foot ulcer management.

METHODOLOGY:

Materials and Method: In this prospective randomized comparative study, totally 30 cases were taken and divided into two groups randomly by lottery method as control group with 15 cases for conventional papain-urea ointment in combination with amorphous hydrogel colloidal silver gel dressing and as interventional group of 15 cases with modified vacuum assisted dressing. All wounds were initially subjected to thorough debridement. Wound bed preparation for SSG was achieved within 3-4 sets of vacuum dressing. Until regular conventional dressing done in control group. All the patients subsequently treated with SSG. Outcome was measured and results are compared.

Study Design:
Randomised prospective comparative study

Place of Study:
This study will be conducted in the Department of Surgery, Karpaga Vinayaga Institute of Medical Science and Research centre, after obtaining approval by the Institutional Ethics Committee.

Duration of Study: 8 months

Sampling: Simple random sampling

Sample Size: 15 cases each totally 30 cases

Inclusion Criteria:
1. Diabetic foot ulcer
2. Venous ulcer
3. Trophic ulcer
4. Chronic non healing ulcer
5. Acute or subacute traumatic wound

Exclusion Criteria:
- Patient who refused to participate
- Pt with untreated osteomyelitis within wound circumference
- Wounds of very large surface area (area more than 30% body surface area, areas like groin, perineum, axilla)
- Malignancy in wound
- Cavity or sinus of unknown depth or origin
- Wound with unstable fractures or loose fragments of bone
- Ulcers over the extremities with peripheral vascular disease
- Wound with exposed blood vessels or organs
- Acute burns
- Patient on anticoagulant
- Fistulas

Study Instuments-
- Autoclaved sponge foam (double autoclaved at pressure of 20 PSI, 250°F for 30 min)
- Romovac drain 14F,
- Wall mount suction machine
- Opsite sheet
- Surgical glove of appropriate size
- Transparent adhesive tape/micropore

- Blade.
- Roller gauze
- Conventional papain-urea ointment in combination with amorphous hydrogel colloidal silver gel
- Dressing tray
- O.H.P sheets (overhead projector sheet)
- Ryle's tube

Data Collection:

1. Primary data will be collected by principal investigator by interview method.

2. Approval from ethics committee

3. Written informed consent from patient before enrolment

4. Patient subjected to clinical examination and evaluated for vitals and clinical signs

5. Investigations (1) standard radiological assessment of the injured wound, (2) routine haematological investigation, for example, complete blood count, ESR, blood sugar, HIV and HbsAg, Gram's stain and culture, (3) all patients were supplemented with standard nutritional supplements, including zinc and multivitamin daily

6. Diagnosis

7. Thorough debridement of the wound from necrotic slough after hemostasis wound surface area is measured by imprint of plastic sheet over graph paper and recorded in cm.

8. Group A Patients are subjected to serial vacuum dressing till granulation tissue appears

9. Group B patients are subjected to serial conventional papain-urea ointment in combination with amorphous hydrogel colloidal silver gel dressing till granulation tissue appears

10. The efficacy of wound healing indicated by clearing the infection is measured by sequential wound swab cultures in both experimental and control group

11. Both groups are subjected to split skin grafting.

12. Results are analysed

Statistical Methods

Descriptive analysis was carried out by frequency and proportion for categorical variables & Mean and Standard deviation for continuous variable. Data was also represented using appropriate diagrams like pie diagram, bar chart.

Chi-square was performed to find out association between two categorical variables.

For normally distributed Quantitative parameters the mean values were compared between study groups using independent sample t-test (2 groups) or paired t test.

P value < 0.05 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis.

RESULTS:

Table 1: Comparison of gender between group (N=30)

Gender	Group	
	Vacuum Dressing (N=15)	Conventional Dressing (N=15)
Female	4 (26.67%)	4 (26.67%)
Male	11 (73.33%)	11 (73.33%)

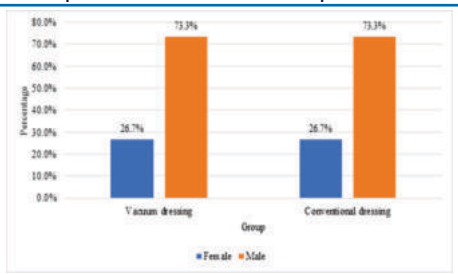

Figure 1: Cluster bar chart of comparison of gender between group (N=30)

Table 2: Comparison of type of wound between group (N=30)

Type Of Wound	Group	
	Vacuum Dressing (N=15)	Conventional Dressing (N=15)
Acute Infectious Ulcer	1 (6.67%)	0 (0%)
Chronic Non-Healing Ulcer	1 (6.67%)	0 (0%)
Diabetic Foot Ulcer	8 (53.33%)	9 (60%)
Traumatic Ulcer	3 (20%)	3 (20%)
Trophic Ulcer	1 (6.67%)	0 (0%)
Venous Ulcer	1 (6.67%)	3 (20%)

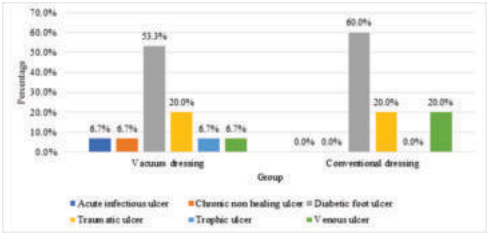

Figure 2: Cluster bar chart of comparison of type of wound between group (N=30)

Table 3: Comparison of complication between group (N=30)

Complication	Group	
	Vacuum Dressing (N=15)	Conventional Dressing (N=15)
Discharge	3 (20%)	0 (0%)
Drainage	0 (0%)	3 (20%)
Drainage, Oedema	0 (0%)	1 (6.67%)
Oedema	0 (0%)	5 (33.33%)
Oedema, Erythema, Drainage	0 (0%)	3 (20%)
Nil	12 (80%)	3 (20%)

Table 4: Comparison of wound culture before dressing between group (N=30)

Wound Culture Before Dressing	Group	
	Vacuum Dressing (N=15)	Conventional Dressing (N=15)
Acinetobacter	2 (13.33%)	2 (13.33%)
E.coli	4 (26.67%)	2 (13.33%)
Klebsiella	2 (13.33%)	0 (0%)
No Growth	0 (0%)	2 (13.33%)
Proteus	3 (20%)	3 (20%)
Pseudomonas	4 (26.67%)	6 (40%)

Table 5: Comparison of wound culture on day 4 between group (N=30)

Wound Culture On Day 4	Group	
	Vacuum Dressing (N=15)	Conventional Dressing (N=15)
E.coli	2 (13.33%)	5 (33.33%)
Klebsiella	1 (6.67%)	0 (0%)
No Growth	10 (66.67%)	2 (13.33%)
Pseudomonas	2 (13.33%)	8 (53.33%)

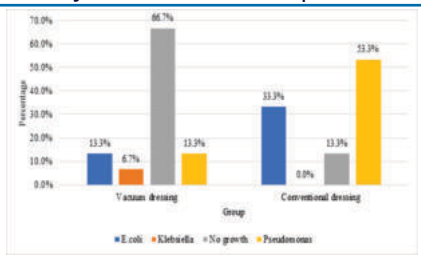

Figure 3: Cluster bar chart of comparison of wound culture on day 4 between group (N=30)

Table6: Comparison of mean of age between group(N=30)

Parameter	GROUP (Mean± SD)	
	Vacuum dressing (N=15)	Conventional dressing (N=15)
AGE	60.73 ± 9.97	60.53 ± 6.32

Table 7: Comparison of mean of wound area in cm2 before debridement between group(N=30)

Parameter	GROUP (Mean± SD)		P value
	Vacuum dressing (N=15)	Conventional dressing (N=15)	
WOUND AREA IN cm2 BEFORE DEBRIDEMENT	71.27 ± 77.23	41.07 ± 29.11	0.167
WOUND AREA IN cm2 AFTER DEBRIDEMENT	74.73 ± 77.2	44.4 ± 30.27	0.168

Table 8: Comparison of mean of no. of debridement between group(N=30)

Parameter	GROUP (Mean± SD)		P value
	Vacuum dressing (N=15)	Conventional dressing (N=15)	
NO. OF DEBRIDEMENT	2.47 ± 2.64	6.13 ± 4.98	0.018
NO. OF DRESSING	2.27 ± 1.1	18.4 ± 13.14	<0.001
WOUND AREA AFTER DRESSING 1st	74.73 ± 77.2	44.4 ± 30.27	0.168
DRESSING 4th	72.4 ± 75.32	43.27 ± 30.16	0.175
DRESSING 8th	87.09 ± 82.68	41.13 ± 29.47	0.057

Table 9: Comparison of mean of SSG uptake pod 4 between group(N=30)

Parameter	GROUP (Mean± SD)		P value
	Vacuum dressing (N=15)	Conventional dressing (N=15)	
SSG UPTAKE POD 4	134 ± 351.19	133.81 ± 351.27	0.999
SSG UPTAKE POD 7	134.03 ± 351.18	133.82 ± 351.26	0.999
COST	1164 ± 697.41	1427.33 ± 1184.97	0.464
WOUND SIZE BEFORE SSG	48.31 ± 31.01	44.46 ± 30.01	0.751
DAY OF APPEARANCE OF GRANULATION TISSUE	8.33 ± 2.79	18.47 ± 13.34	0.008

- Mean patient age was 60±10 years
- It is the diabetic foot ulcer which occupies the majority of the study and it is the highly prevalent type of ulcer among Chengalpattu population. It accounts for 53.3 %– 60% of the entire wound type. Second most common type of wound is traumatic ulcer which accounts for 20%. Third most common type of wound is venous ulcer which accounts for 6.7%- 20%.
- Complications including discharge, erythema, edema after the Vacuum assisted dressing is least common and accounts for only 20%. Remaining 80% of population did not develop any complication. On comparing this to conventional dressing it is 80% of population who developed complication and 20% of population did not developed complication.
- Wound culture of day 4 after vacuum assisted dressing showed 66.7% sterile and in comparison, with conventional dressing showed 13.3% sterile. Hence there was significant decrease in the bacterial growth in the VAC group as compared to conventional papain-urea ointment in combination with amorphous hydrogel colloidal silver gel dressing Since wound is free from bacteria. Pseudomonas (53.3%) found to be the predominant organism followed by E. coli (33.3%) isolated in conventional papain-urea ointment in combination with amorphous hydrogel colloidal silver gel dressing.
- Decrease in Wound Size: There was significant decrease in wound size from day zero to day eight in VAC group in comparison to group for conventional papain-urea ointment in combination with amorphous hydrogel colloidal silver gel dressing
- There is earlier appearance of granulation tissue approximately 8.33 ± 2.79 days in comparison to conventional dressing with amorphous hydrogel colloidal silver gel dressing granulation tissue appears approximately 18.47 ± 13.34 days.
- There is significant decrease in the hospital stay of the patient undergoing vacuum assisted dressing and also found to be cost effective around Rs. 1164 ± 697.41 whereas in contrast to this the conventional dressing costs around Rs. 1427.33 ± 1184.97
- SSG uptake is good about 85-99% in case of vacuum dressing whereas for conventional dressing it is little less about 65-85%

DISCUSSION:

A wound is a break in integrity of skin or tissues which is associated with disruption of the structure and function [14]. Wound healing is a complex process to achieve anatomical and functional integrity of disturbed tissue by various component in a organized three phases. It includes 1) Inflammatory phase, 2) Proliferative phase, 3) Remodelling phase [15]. For achieving this wound healing there are many types of dressing available which includes open wound dressing, conventional closed wound dressing, synthetic dressing, biological dressing, vacuum assisted closure dressing. This vacuum assisted closure is one of the upcoming most widely used technique for wound healing. The practise of exposing a wound to sub atmospheric pressure for an extended period to promote debridement and healing was first described by Fleischmann et al in 1993.

VAC applies an intermittent negative pressure of approximately -125mmHg to hasten debridement and for formation of granulation tissue in chronic wound and ulcer. This negative pressure acts by decreasing oedema, by increasing blood flow, increasing cell proliferation and decreases bacterial counts thereby creating a suitable bed for graft or flap cover.

It is one of the sophisticated developments of a standard surgical procedure. It is a very simple technique where a piece of foam is introduced into the wound and a wound drain with lateral perforation is laid on top of it. Followed by which entire area is then covered with a transparent adhesive sheet which is firmly secured to the healthy skin around the wound. The exposed end of the drain tube is connected to a vacuum source. The plastic membrane seals the foam air tight and

prevents ingress of air and allow partial vacuum to foam within the wound. The foam ensures that the entire surface area of wound is uniformly exposed to this negative pressure effect[16].

Numerous other paper have described the use of VAC in the treatment of variety of wound types including extensive degloving injury [20][21], infected sternotomy wounds [19][22][23], various soft tissue injuries prior to surgical closure [24], grafting or reconstructive surgery [25]. The VAC allows us to temporarily cover an open wound and maintain the sterile environment while surgical planning and repeated debridement. For injuries more distally the VAC dressing reduces oedema, can maintain and mould the hand and wrist in a functional position. It may help to stabilize fractures. Thus, VAC provides temporary splinting as well as a bridge to definitive soft tissue coverage and reconstruction [17]

Patients with an open abdomen are managed with vacuum assisted closure therapy. This provides a temporarily closed environment where negative pressure is applied to wound. Such system are changed at 48hrs interval until abdomen is closed. It is Smith et al[18] who did a retrospective review describing the use of VAC in open abdomen management in variety of conditions.

VAC is used in conjunction with SSG in treating burns, chronic non healing wound. Thus VAC therapy can be regarded as a method that combines the benefit of both open and closed treatment and adheres of being short, safe, and simple. It has been shown to work and be beneficial to wound healing. VAC therapy is not the answer for all wounds; however, it can make a significant difference in many cases. VAC is most useful in difficult cavity or highly exudative wounds. VAC is a useful tool in moving a wound to a point where more traditional dressings or more simple surgical reconstructive methods can be used. As such it is a well deserved, although at present pragmatic addition to the wound healing armamentarium and the reconstructive ladder [26].

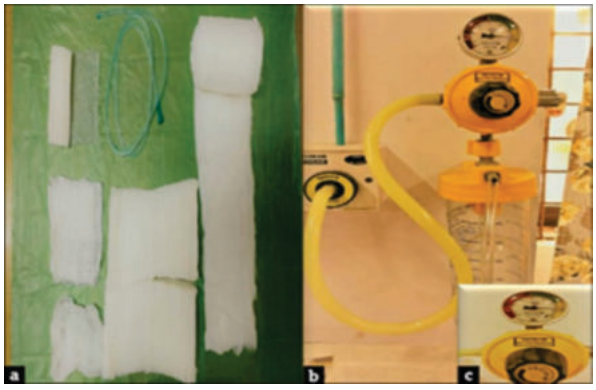

FIGURE 4: Instruments that are required for VAC. It includes drain, foam, wall mount vacuum suction apparatus.

Figure 5: conventional dressing using the papain-urea ointment in combination with amorphous hydrogel colloidal silver gel and roller guaze

Figure 6: Split Skin Grafting

CONCLUSION:

Through this study it has been proven that modified vacuum assisted therapy is more beneficial when compared to the conventional papain-urea ointment in combination with amorphous hydrogel colloidal silver gel dressing, compared in parameters of granulation tissue formation, clearance of the infection over the wound, decreasing the duration of hospital stay, and cost effectiveness than compared to moist dressings.

CONSENT

Written informed consent was obtained from the patient for publication of this study and any accompanying images

Competing Interests

The authors declare that they have no competing interests

Abbreviations

SSG -Split Skin Graft
ESR – Erythrocyte Sedimentation Rate
HIV – Human immunodeficiency virus
HbsAg – Hepatitis B s Antigen
VAC – Vacuum assisted closure

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