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Effect of with and without Vacuum Assisted Closure on Split Thickness Skin Graft: A Prospective Study

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ABSTRACT

Background: Split thickness skin graft (STSG) is most commonly used in coverage of skin defect wounds. The technique of vacuum assisted closure on STSG is a good alternative to conventional dressing over STSG. The aim of this study was to compare the effect of vacuum assisted closure on STSG with conventional method of STSG.
Methods: This prospective study was conducted from January 2023 to January 2024 in the department of plastic surgery in NKPSIMS, Nagpur. Patients were divided into two groups with sample size of 30 in each group. Group 1 consisted of patients treated with STSG by conventional method of dressing. Group 2 consisted of patients treated by vacuum assisted closure on STSG.
Results: Graft take on day 8th, day 12th and day 15th with conventional method of STSG group were 80.17 ± 8.66%, 86.67 ± 10.03%, and 93.50 ± 10.01% respectively and graft take in vacuum assisted closure on STSG group were 83.50 ± 8.00%, 90.50 ± 5.14%, and 98.50 ± 4.50% respectively.
Conclusion: Our study concluded that application of vacuum assisted closure on STSG proved to be beneficial in terms of better graft take, less post-operative hospital stays, better patient compliance, less redo surgery and cost effective.

Keywords: Split thickness skin graft, vacuum assisted closure, conventional method of dressing, bolster dressing, wounds

INTRODUCTION

Managing soft tissue coverage for defects of the wounds caused by trauma, burns, necrotising fasciitis and non-healing ulcers presents a significant therapeutic challenge. Postoperative complications can extend hospitalization, increase medical expenses, and increase morbidity to the patient.[1] Therefore, the approach to wound coverage has gained increasing importance.[2] Wounds are usually large with significant soft tissue loss which usually require reconstruction for soft tissue coverage.[3] Extensive raw areas are usually managed by covering it with Split thickness skin graft (STSG). Skin graft take depends on the dressing methods used for the grafting. The process of graft integration at the recipient site occurs in three stages: plasmatic imbibition, inosculation and revascularisation.[4] Graft loss commonly occurs due to hematoma formation under the graft, graft infection and shear forces acting on the graft. Large raw areas due to graft loss demands redo surgery.

Conventional method of dressing (bolster dressing)

Conventional method of dressing over the STSG, done by covering graft with petroleum gauze and betadine-soaked cotton pieces with or without tie over dressing. Suboptimal graft take in conventional method of dressing is seen due to hematoma formation and shearing of the interface. To avoid these complications nowadays conventional method of dressing is replaced by VAC over STSG. [5-7]

Vacuum assisted closure (VAC)

VAC is synonymously also known by "negative pressure wound therapy (NPWT)". Wound healing is enhanced by VAC dressing.[8]

The technique involves applying foam over the petroleum gauze which is placed over the wound and this foam is fixed to skin with staplers. Then the dressing is covered with adhesive films which is connected with the canister and machine through tube. This machine maintains controlled negative pressure over the wound.

Vacuum assisted closure has also been utilised over raw area for wound bed preparation to facilitate granulation prior to skin grafting. [9,10] Negative pressure for wound bed preparation is usually kept around 125 mm Hg.

The technique of vacuum assisted closure was originally found by Morykwas et al. [11] VAC applied over STSG helps in increased chances of graft take by preventing hematoma formation and maintaining immobilisation.

The use of VAC on STSG has been documented in various studies with promising results. [12-17]

The aim of this study was to compare "the effect of vacuum assisted closure on split thickness skin graft with conventional method of dressing on split thickness skin graft".

MATERIALS AND METHODS

This prospective study was conducted in the department of plastic surgery in NKPSIMS & RC and Hospital, Nagpur. Patients were divided into two groups consisting of 30 patients each. Group 1 consisted of patients treated with split thickness skin graft by conventional method of dressing. Group 2 consisted of patients treated by vacuum assisted closure on split thickness skin graft.

Study period

Study was conducted from January 2023 to January 2024

Ethical approval

Ethical approval was taken from the Ethical committee at NKPSIMS & RC and Hospital, Nagpur.

Inclusion criteria

- Well granulated wounds
- Wound defect size ≤15% of the body surface area
- Haemoglobin more than or equal to 10 gm/dL
- Serum albumin more than or equal to 3 gm/Dl
- Patients of all age group

Exclusion criteria

- Wound defect over the face
- Wound defect more than 15% of the body surface area

Study Methodology

Enrollment and Consent:

Patients matching the required criteria were selected in the study. The enrolled patients and their relatives were informed and explained about the study in detail and consent was taken.

Data Collection:

Patients' demographic details with comorbidities and detailed history of the disease and wound were taken. Local examination of the wound was done. Appropriate and required investigations were performed.

Initial Treatment:

Initial surgical wound debridement was performed with application of vacuum assisted closure in dirty and infection

wounds. Split-Thickness Skin Graft was applied once the wound bed appeared to be covered with healthy granulation tissue.

Group Allocation:

- Group-1: "split thickness skin graft by conventional method of dressing".
- Group-2: "vacuum assisted closure on split thickness skin graft".

Conventional Method of Dressing:
In conventional method of dressing, the STSG was covered with petroleum gauze and cotton gauze immersed in betadine and covered with cotton roll and elastocrepe bandage. Bolster dressing was given wherever required. Splinting was done in physiological position for immobilizing the grafted area. The 1st dressing was done on POD-5.

Vacuum Assisted Closure (VAC):
In vacuum assisted closure technique, STSG was secured to the wound with skin staplers and covered with petroleum gauze. The VAC sponge was cut in the exact size of the wound contour and fixed with skin staplers. Negative suction pressure of 75-100 mm Hg was maintained using a vacuum pump.

Postoperative Care and Assessment:
Splinting was given in both groups for immobilization, dressing in group 1 was opened on POD-5 and dressing in Group-2 was opened on POD-8 and further wound assessment were done on 8th, 12th and 15th post-operative days.

Statistical analysis

Continuous variables were summarized as mean±standard deviation (SD). Comparisons of mean duration of hospitalisation, post-surgical hospitalisation, and percentage graft take between the two groups were performed using appropriate inferential statistical tests. A two-tailed p value of <0.05 was considered statistically significant.

RESULTS

Table 1: Summary characteristics of the study.

Characteristics	Group-1(conventional dressing)	Group-2 (VAC)
N (total =60)	30	30
Age (years)	34.73	34.83
Sex (male/female)	17/13	19/11
Diabetes	9	11
Mean days of admission (days±SD)	31.83 ± 19.51	28.63 ± 11.35
Post STSG duration of stay (days±SD)	21.67 ± 11.57	15.20 ± 6.16
Grafted area (cm2) (mean±SD)	69.33 ± 18.13	96.87 ± 25.48
% of graft take at 5th day follow-up (%±SD)	68.33 ± 11.99	
% of graft take at 8th day follow-up (%±SD)	80.17 ± 8.66	83.50 ± 8.00
% of graft take at 12th day follow-up (%±SD)	86.67 ± 10.03	90.50 ± 5.14
% of graft take at 15th day follow-up (%±SD)	93.50 ± 10.01	98.50 ± 4.58
Complications in graft failure	10%	3.33%
Need for redo SSG	10%	3.33%

Demographic data:
In group-1 (conventional dressing), among the 30 total patients, there were 17 male and 13 female patients, out of which 3 patients were <10 years in age, 15 were between 10 years to 40 years age group and 12 patients were above 40 years of age.

In group-2 (VAC), among these 30 patients 19 were male and 11 were female, out of which 2 patients were <10 years in age, 18 were between 10 years to 40 years age group and 10 patients were above 40 years of age.

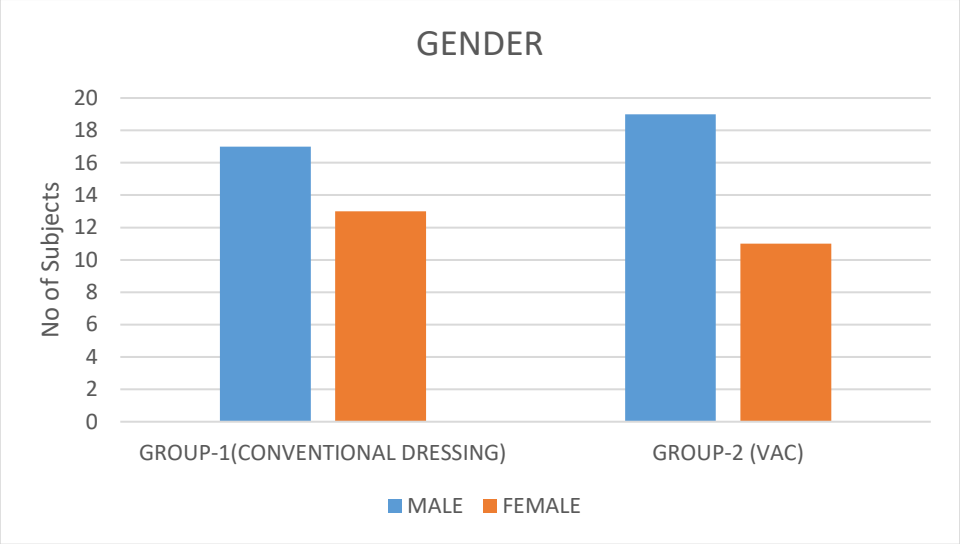

Figure 1: Gender Profile

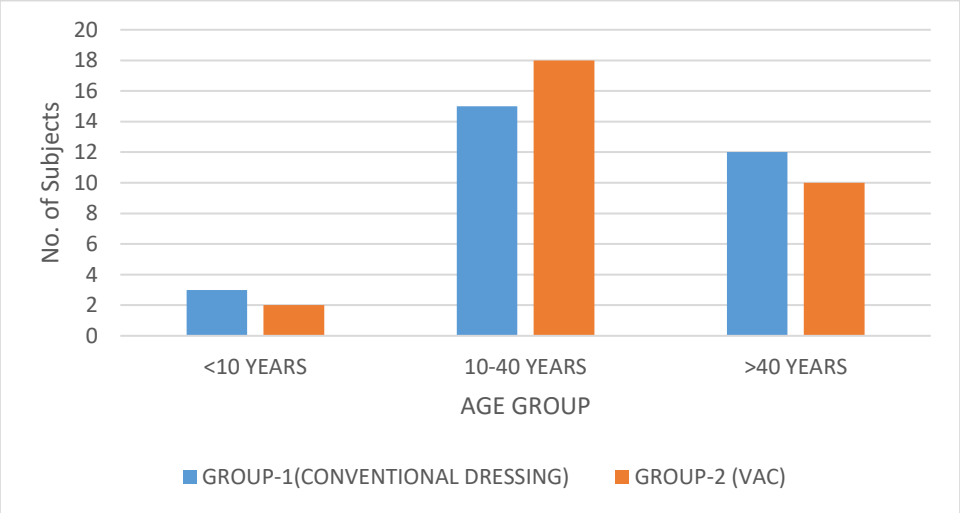

Figure 2: Age Distribution

Etiology and site of wound:

Most of the patients in group-1 (conventional dressing) had history of injury due to trauma and necrotising fasciitis and most of the patients in group-2 (VAC) had history of trauma and burns.

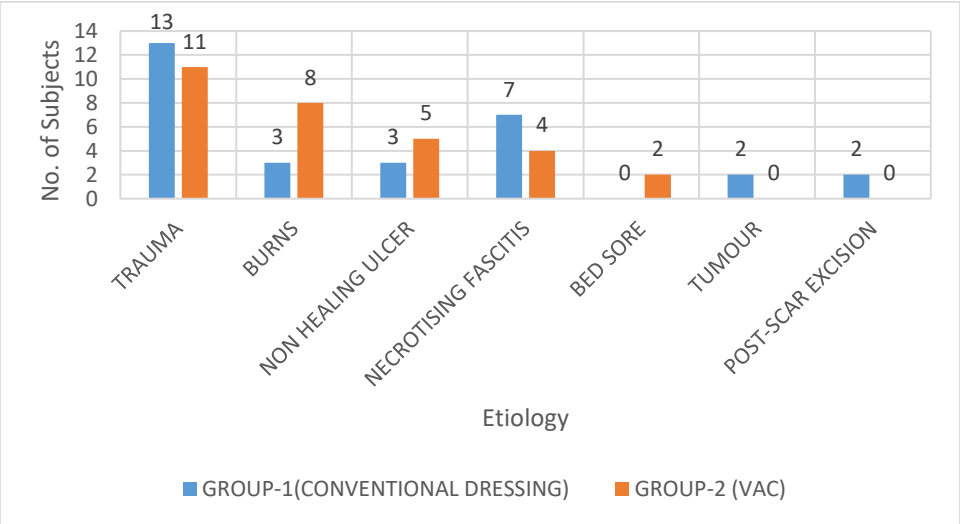

Figure 3: Etiological Classification

Maximum number of patients in both the groups showed wound over the lower limbs followed by upper limb.

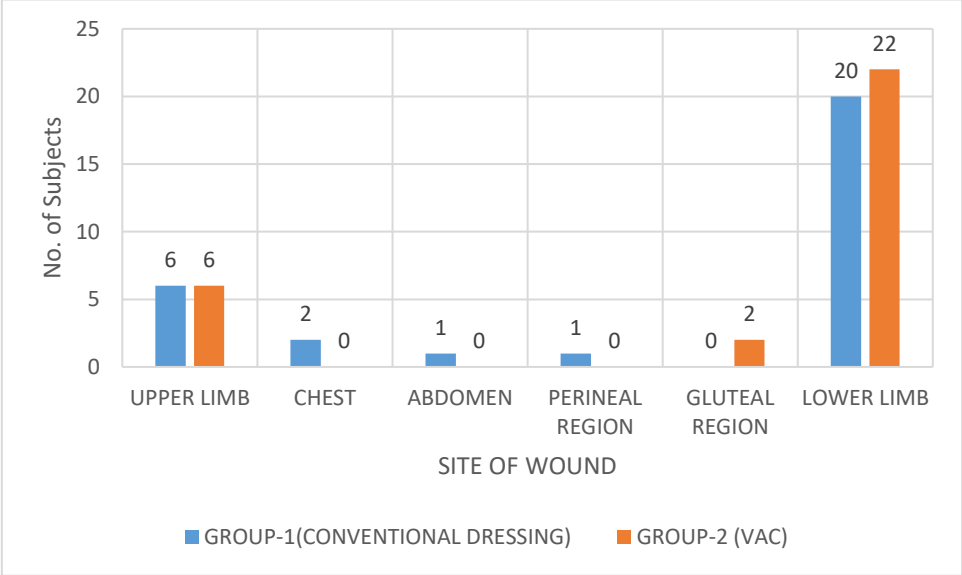

Figure 4: Site of wound

Hospital stays:

Mean duration of hospitalisation in group-1 was 31.83 ± 19.51 and in group-2 was 28.63 ± 11.35. Mean duration of post-surgical hospitalisation in group 1 was 21.67 ± 11.57 and in group-2 was 15.20 ± 6.16. p-value turned out to be 0.009 (<0.05) for post-surgical hospitalisation, indicating statistical difference between the groups.

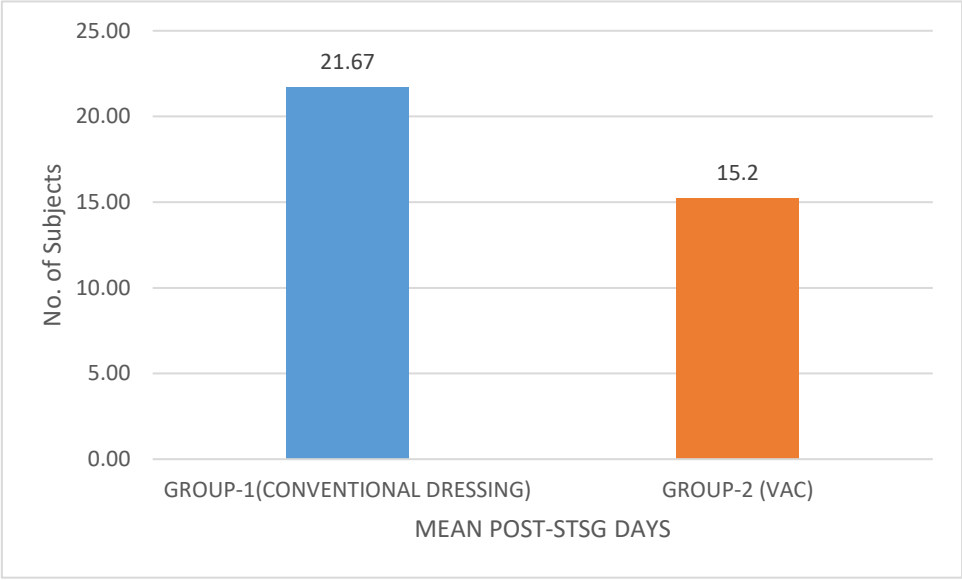

Figure 5: Duration of Post-STSG Stay

Hospital cost:

Mean hospital cost in group-1 was 6366.67 ± 3901.93 rupees and in group-2 was 5726.67 ± 2269.12 rupees.

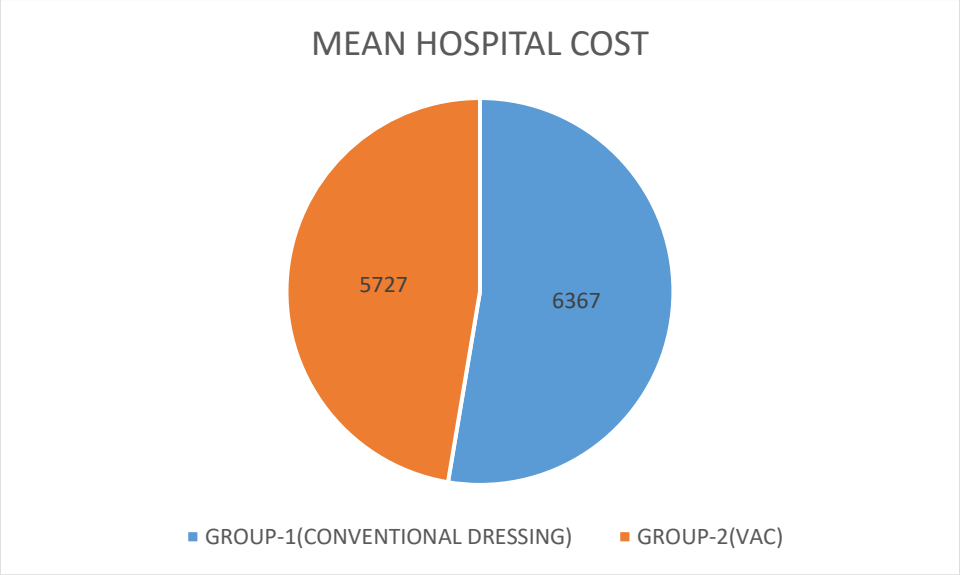

Figure 6: Mean Hospital Cost

Comorbidities:

In this study, diabetes was encountered in 9 (30%) patients in group-1(conventional dressing) and in 11 (36.66%) patients of group-2(VAC). Total graft loss was seen in 2 patient of group-1(conventional dressing) out of those 9 patients having diabetes which required re-grafting. No total graft loss no requirement of redo surgery was seen in group-2(VAC) patients having diabetes.

Graft uptake:

In this study, graft take on POD-5th in group-1(conventional dressing) was 68.33 ± 11.99.

On POD-8th graft take in group-1(conventional dressing) was 80.17 ± 8.66 and in group-2(VAC) was 83.50 ± 8.00. p-value is 0.12 (>0.05) showing no significant difference between both groups.

On POD-12th graft take in group-1(conventional dressing) was 86.67 ± 10.03 and in group-2(VAC) was 90.50 ± 5.14. p-value is 0.06 (>0.05) showing no significant difference between both groups.

On POD-15th graft take in group-1(conventional dressing) was 93.50 ± 10.01 and in group-2(VAC) was 98.50 ± 4.58. p-value is 0.01 (<0.05) showing significant difference between both groups.

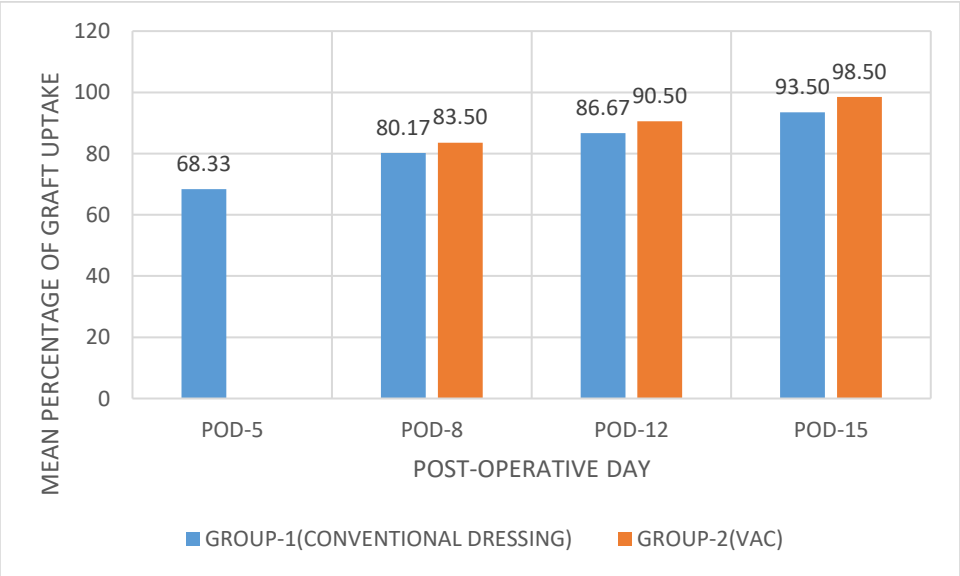

Figure 7: Graft Uptake

Complications:

Graft loss was seen in 3 patients out of 30 in group-1 (conventional dressing) with rate of redo surgery being 10% and in group-2(VAC) 1 patient out of 30 showed graft loss with rate of redo surgery being 3.33%.

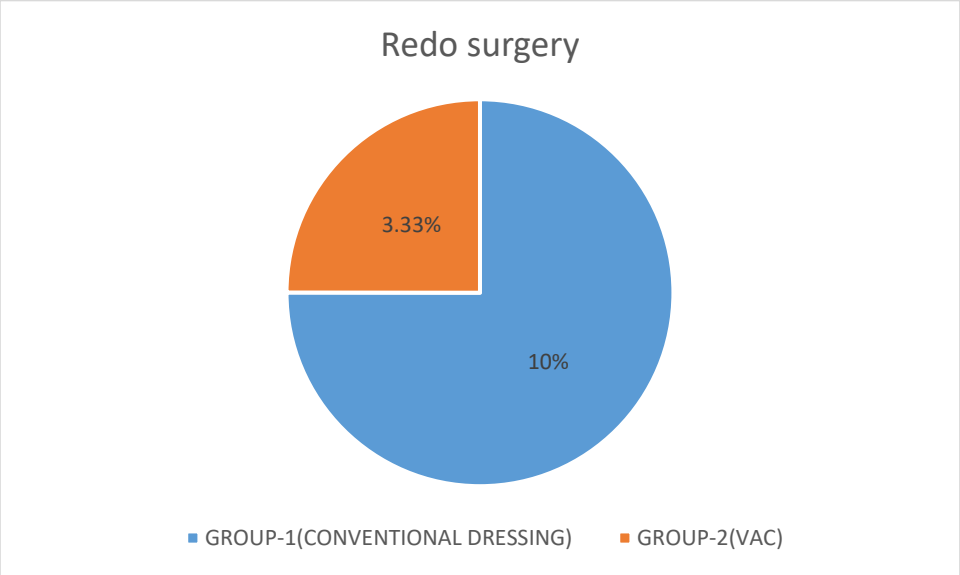

Figure 8: Rate of Redo Surgery

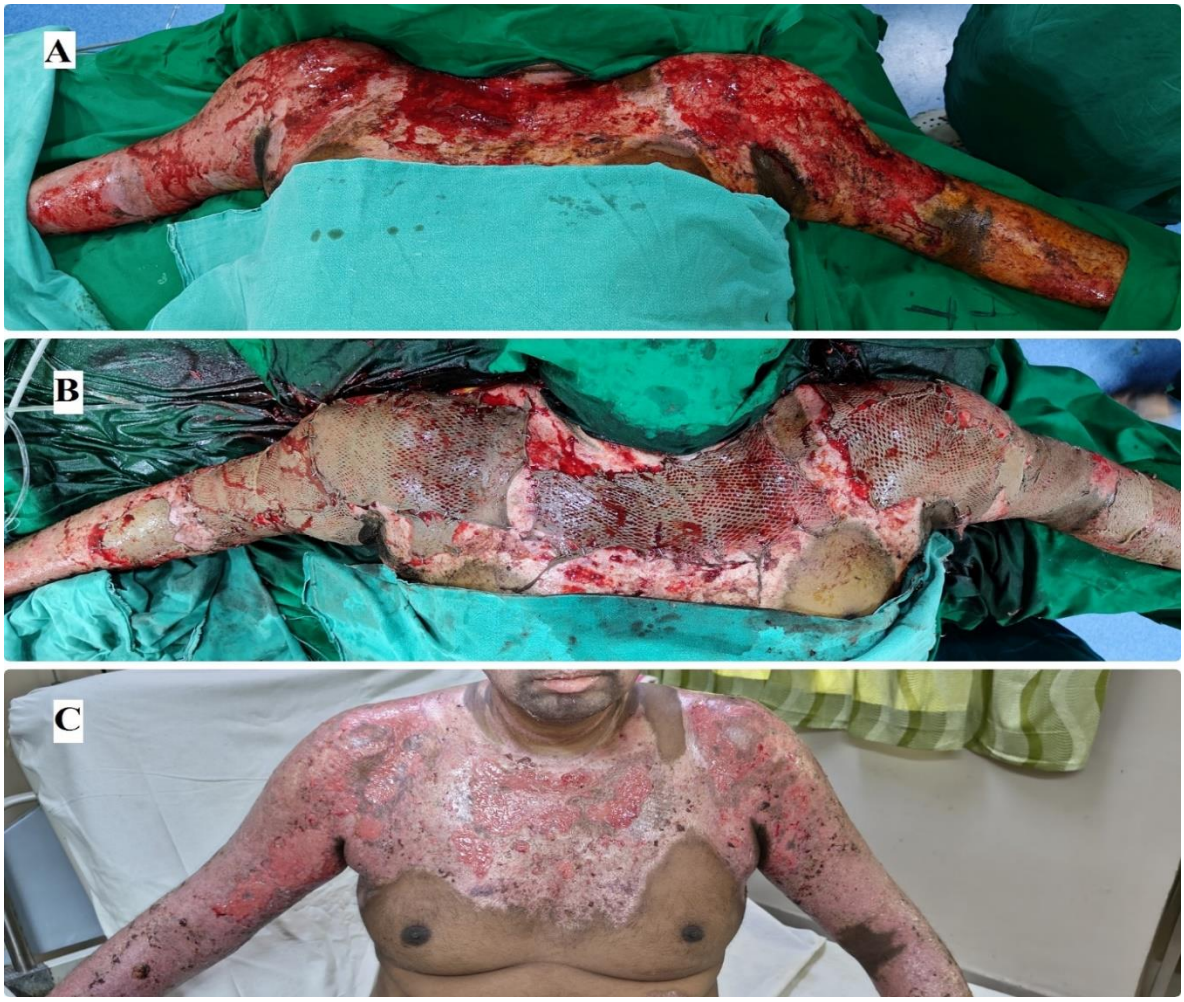

Figure 9: GROUP-1 (Conventional Dressing). [A] Pre-Operative, [B] Intra-Operative After STSG, [C] Post-Operative Day 15.

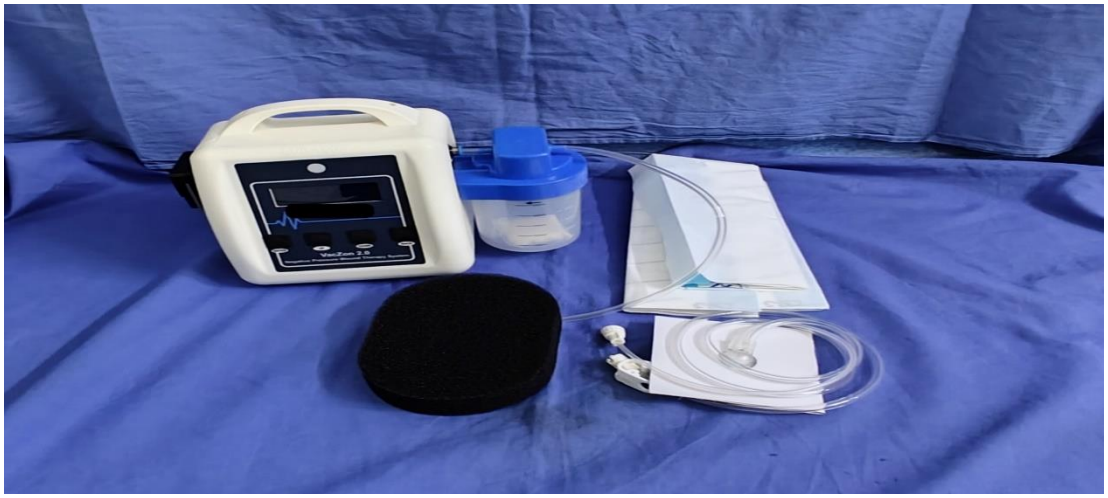

Figure 10: Vacuum Assisted Closure Apparatus and Materials.

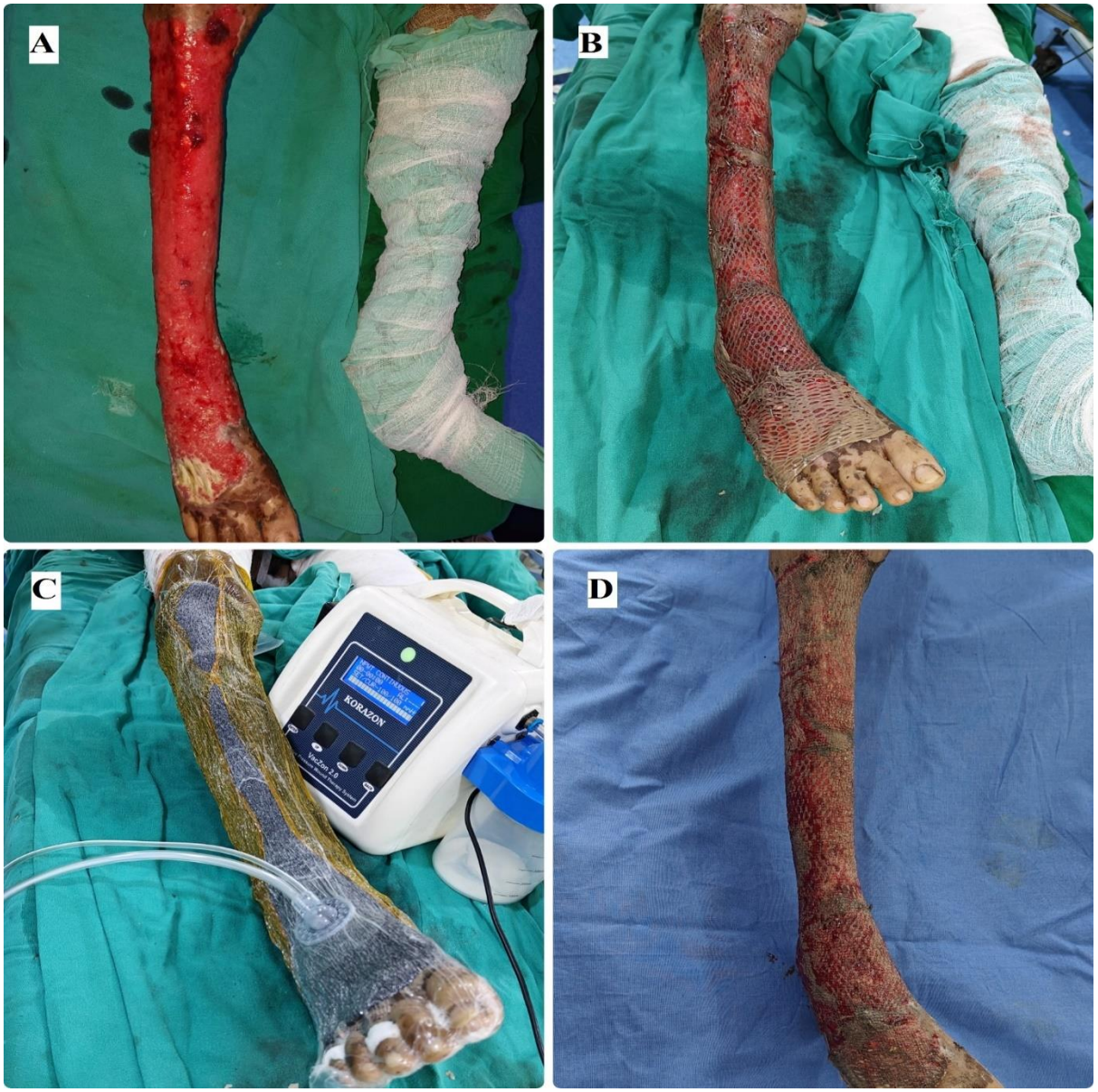

Figure 11: GROUP-2 (Vacuum Assisted Closure). [A] Pre-Operative, [B] Intra-Operative After STSG, [C] Intra-Operative After STSG With VAC Applied, [D] Post-Operative Day 15.

DISCUSSION

In our study, group-1 (conventional dressing) showed 17 male and 13 female patients out of which 3 were <10 years of age, 15 were among 10-40 years of age group and 12 were >40 years of age and in group-2 (VAC) 19 were male and 11 patients were female of which 2 were <10 years in age, 18 were between 10-40 years of age and 10 patients were above 40 years of age.

In a study by Agrawal et al, VAC group showed 10 patients falling between 10-40 years and 20 were >40 years of age out of which 24 were male and 6 were female. In traditional bolster dressing group, there were 22 male patients and 8 female patients out of which 3 patients were <10 years of age, 14 between 10-40 years and 13 were >40 years of age. [18]

In present study, the mean duration of hospitalisation in group-1 was 31.83 ± 19.51 and in group-2 was 28.63 ± 11.35 days. In study by Agrawal et al, mean duration of hospitalisation in negative pressure wound therapy group was 13.47 ± 4.3 days and in traditional bolster dressing group was 16.9 ± 5.8 days. [18] In study by Llanos et al, mean duration of hospitalisation was 13.5 days in the VAC group versus 17 days in the conventional dressing group. [19] The findings of our present study were consistent with other study groups with respect to duration of hospitalisation showing shorter hospitalisation in vacuum assisted closure group. In our present study, mean duration of post-surgical hospital stay in group 1 was 21.67 ± 11.57 and in group-2 was 15.20 ± 6.16. p-value was calculated to be 0.009 (<0.05) for post-surgical hospital stay, showing statistical difference between the groups. In literature by Agrawal et al, VAC group showed mean post STSG days to be 5.6 ± 1.2 days and conventional group showed result of 7.4 ± 1.4 days. [18]

In a literature by Petkar et al, Post STSG hospitalisation in VAC group was 8 ± 1.48 days and in conventional group was 11 ± 2.2. [20] The results of our study showed comparable results with other literatures indicating shorter post-STSG hospital stay in VAC group.

In our study, graft take on POD-5th in group-1was 68.33 ± 11.99. Graft take on POD-8th in group-1 was 80.17 ± 8.66 and in group-2 was 83.50 ± 8.00. Graft take on POD-12th in group-1 was 86.67 ± 10.03 and in group-2 was 90.50 ± 5.14. Graft take on POD-15th in group-1 was 93.50 ± 10.01 and in group-2 was 98.50 ± 4.58.

In study by Agrawal et al, graft take on POD-5th in VAC group was 83.16 ± 4.1% and in conventional group was 78.12 ± 3.76%. Graft take on POD-7th in VAC group was 89.83 ± 4.12% and in conventional group was 84.33 ± 4.66%. Graft take on POD-9th in VAC group was 96.33 ± 5.3% and in conventional group was 92.67 ± 5.24%.[18]

In a article by Petkar et al, graft take in VAC group was 95.5 ± 4.33 % and in conventional group was 86.7 ± 6.71%.[20]

In study by Pyo et al, showed less graft loss and improved graft take in VAC therapy group, also showed ease of dressing and handiness.[21] Our study showed comparable results with other contemporary studies with higher graft take in vacuum assisted closure applied over STSG. In our present surgery, the rate of redo surgery in group-1 (conventional dressing method) was 10% and in group-2 (VAC) was 3.33%. In study by Agrawal et al, rate of redo surgery in VAC group was 6.67% and in TBD group was 10%. [18] In a study by Llanos et al, need of redo surgery in VAC group was 8.5% and in traditional dressing group was 14%. [19] Results of the present study were consistent with the results of other studies.

CONCLUSION

Applying VAC to STSG offers several benefits, including improved graft uptake, reduced infection rates, shorter hospital stays post-grafting, cost effective and better patient compliance than conventional dressing method of STSG. The need for repeat skin grafting (STSG) procedures is also minimized with VAC. The findings from this study indicate that VAC dressings accelerate graft take, making them especially

advantageous in anatomically challenging graft sites, highly contoured graft beds, and less-than-ideal grafting conditions. Consequently, this study enhances knowledge and understanding of VAC by demonstrating its effectiveness in promoting better graft uptake and reducing complications.

Declaration by Authors

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Conflict of Interest: The authors declare no conflict of interest.

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