



# Experience of Vacuum-Assisted Closure in the Surgical Treatment of Malignant Skin Tumors after Skin Grafting

Sergii Korovin, Vasyi Ostafiichuk, Serhii Diedkov, Mariia Kukushkina<sup>ID\*</sup>

Department of Skin and Soft Tissue Tumors, National Cancer Institute of Ukraine, Kiev, Ukraine

## Abstract

**Edited by:** Ksenija Bogoeva-Kostovska  
**Citation:** Korovin S, Ostafiichuk V, Diedkov S, Kukushkina M. Experience of Vacuum-Assisted Closure in the Surgical Treatment of Malignant Skin Tumors after Skin Grafting. Open Access Maced J Med Sci. 2022 Nov 26; 10(B):2520-2522. https://doi.org/10.3889/oamjms.2022.11046  
**Keywords:** Skin tumors; Grafts; Vacuum-assisted closure  
**\*Correspondence:** Mariia Kukushkina, Department of Skin and Soft Tissue Tumors, National Cancer Institute of Ukraine, Kiev, Ukraine.  
E-mail: mkukushkina07@gmail.com  
**Received:** 04-Oct-2022  
**Revised:** 11-Nov-2022  
**Accepted:** 16-Nov-2022  
**Copyright:** © 2022 Sergii Korovin, Vasyi Ostafiichuk, Serhii Diedkov, Mariia Kukushkina  
**Funding:** Ministry of Health of Ukraine (0122U002449)  
**Competing Interests:** The authors have declared that no competing interests exist  
**Open Access:** This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0)

**BACKGROUND:** Skin grafts may be used to reconstruct large skin defects after the excision of malignant skin tumors. Vacuum-assisted closure (VAC) leads closer approximation of the free flap.

**AIM:** The objective of this study was to estimate the engraftment of grafts using VAC and explore factors influencing this process.

**MATERIALS AND METHODS:** This study included 31 patients with skin cancers after a wide tumor excision. The wound defects were closed using a split-thickness skin graft and the VAC dressing.

**RESULTS:** Complete and partial engraftment was observed in 17 (54.8 %) and 14 (45.2%) cases, respectively. The mean area of the wound defects among patients with complete engraftment was  $24.3 \pm 20.6 \text{ cm}^2$ , while that of the group with partial engraftments was  $56.5 \pm 58.8 \text{ cm}^2$  ( $p = 0.0017$ ). In the complete engraftment group, the average number of days with the VAC dressing was  $7.2 \pm 0.44$  days, versus  $6.9 \pm 0.27$  days in the partial engraftment group ( $p = 0.032$ ).

**CONCLUSION:** VAC dressing after skin grafting in the surgical management of malignant skin tumors provided good results. The area of the wound defect and the average number of days with VAC dressing is significant factors influencing the outcomes of skin grafting.

## Introduction

The surgical management of malignant skin tumors requires wide excision, with safety margins ranging from 0.4–0.6 cm to 2 cm, according to the modern guidelines [1], [2]. Skin flaps, such as split-thickness skin grafts, may be used to reconstruct large defects. Vacuum-assisted closure (VAC), which creates negative pressure over the wound surface, leads to better removal of wound discharge and closer approximation of the free flap [3].

## Materials and Methods

The study protocol was reviewed and approved by the Ethical Committee of the National Cancer Institute of Ukraine and conformed to the ethical guidelines of the 1975 Declaration of Helsinki. Informed consent was obtained from each patient.

From January 2019 to December 2021, 31 patients (23 women, eight men; age range, 23–86 years; mean age  $58.3 \pm 13.9$  years) with

malignant skin tumors were included in our study; of these, 20 (64.5%) had concomitant chronic diseases. Skin melanoma (T1a-4bN0-2bM0), squamous cell skin cancer (T1-2N0-1M0), and basal cell skin cancer (T1-2N0M0) were diagnosed in 23 (74.2%), six (19.4%), and two (6.4%) patients, respectively, and 25 (80.6%) had primary tumors, while six (19.4%) had recurrent tumors. In 27 (87.1%) cases, tumors were localized to the extremities and 22 (70.9%) of them localized to 1/3 of shins and plantar surface of feet. Two (6.5%) cases had tumors localized to the trunk and two (6.5%) cases had tumors localized to the head. The deep of wounds ranged from 5 to 15 mm. The wound defect area after tumor excision was calculated using the formula for determining the area of an ellipse ( $S = \pi \times a/2 \times b/2$ ), where a is the length of the wound and b is its width.

After making a wide skin excision, the wound defects were closed using a split-thickness (0.3–0.4 mm) skin graft. A VAC dressing with a mean pressure of  $96.1 \pm 12.0$  mmHg was applied for 6–8 days postoperatively. Portable XLR8 Negative Pressure Wound Therapy pump (*Genadyne*) with fully reticulated polyurethane foam was used for continuous under pressure. Antibiotic prophylaxis was not used in all cases but considered to each patient's particular situation.

Skin engraftment was assessed after the removal of the VAC dressings. In cases with skin graft

necrosis, the wounds healed by secondary intention with the application of conventional ointment dressings.

For statistical analysis, methods of descriptive statistics (mean and standard deviation for quantitative indicators and data distribution in % for qualitative data) were used. The Mann–Whitney and Chi-square tests were used to compare the quantitative parameters and frequency distributions of qualitative features.

## Results

The wide excision of the skin tumors resulted in wound defects ranging from 4 to 659 cm<sup>2</sup>.

The visualized viable area of the skin graft was used to evaluate the immediate result of skin engraftment after removing the VAC dressing. Complete engraftment was observed in 17 (54.8%) cases. In 14 (45.2%) cases, partial necrosis of the donor graft was noted; however, in eight (25.8%) cases, >50% of the graft area was engrafted. The area of partial necrosis varied from 10 to 90%, and the mean area of necrosis was 55.0 ± 31.6%. Complete rejection of the skin graft was not observed in the present study. In cases of skin graft necrosis, the wounds healed by secondary intention with the application of conventional ointment dressings for 1–10 weeks.

We examined the influence of demographics and skin tumor characteristics on skin engraftment (Table 1).

**Table 1: Influence of demographics and skin tumor characteristics on skin engraftment**

Characteristic	Complete engraftment (n = 17) (%)	Partial engraftment (n = 14) (%)	p
Age, years	61.6 ± 15.4	54.2 ± 11.1	0.084 (U)
Sex			
Male	13 (76.5)	10 (71.4)	0.750 (x <sup>2</sup> )
Female	4 (25.5)	4 (28.6)	
Skin tumor			
Primary	15 (88.2)	10 (71.4)	0.39 (x <sup>2</sup> )
Recurrent	2 (11.8)	4 (28.6)	
Area of wound defect, cm <sup>2</sup>	24.3 ± 20.6	56.5 ± 58.8	0.017 (U)
Concomitant chronic diseases			
Present	4 (23.5)	7 (50.0)	0.135 (x <sup>2</sup> )
Absent	13 (76.5)	7 (50.0)	
Average number of days with VAC dressing	7.2 ± 0.44	6.9 ± 0.27	0.032 (U)
Pressure of VAC dressing, mmHg	94.1 ± 13.7	98.6 ± 9.5	0.250 (U)

VAC: Vacuum-assisted closure.

Two factors differing significantly between the comparison groups were noted. First, among patients with complete engraftment, the mean area of the wound defect was 24.3 ± 20.6 cm<sup>2</sup>, while that of the group with partial engraftments was 56.5 ± 58.8 cm<sup>2</sup> (p = 0.0017). Second, in the complete engraftment group, the average number of days with a VAC dressing was 7.2 ± 0.44, versus 6.9 ± 0.27 days in the partial engraftment group (p = 0.032). It should be noted that in the group with complete engraftments, there were fewer patients with comorbidities than there were in the group with partial engraftments (four [23.5%] and seven [50.0%], respectively (p = 0.135).

During the follow-up period, which ranged from 6 to 35 months, two (6.4%) patients with recurrent skin melanoma (T3aN1aM0 and T4aN0M0) had a local relapse and satellite metastases within 3 months postoperatively.

## Discussion

Split-thickness skin grafting requires good immobilization. Immobilization between the wound bed and skin graft guarantees full engraftment, but it is quite challenging to provide such conditions using standard dressings on a functioning limb. VAC dressing has been widely used in surgical practice for several decades and could be helpful in such circumstances.

In our study, using VAC dressings did not lead to any local or systemic purulent complications or exacerbation of chronic diseases. In 80% of the patients (54.7% with complete engraftment and 25.8% with engraftment of >50% of the skin graft area), the results of the treatment could be considered satisfactory. The relatively high rate of partial graft take in our study can be explained by a large number 2 (2 [70.9%]) of awkward or difficult to close anatomical areas where skin tumor localized.

Among the six patients with recurrent malignant skin tumors included in the study, relapses occurred in two (33%). Thus far, it is difficult to discuss the oncological safety of VAC dressings in treating skin tumors due to the relatively short follow-up period.

The use of VAC dressings after skin grafting in the surgical management of malignant skin tumors provided good results, with 54.7% complete engraftments, 25.8% engraftments of >50% of the graft area, and 0% complete necrosis. The area of the wound defect and the average number of days with VAC dressing are significant factors that influence the outcomes of skin grafting. The risk of local progression after application of a VAC dressing is higher in patients with recurrent malignant skin tumors than in those with primary tumors.

The aim of our pilot study was to evaluate graft engraftment with VAC and to investigate the factors that influence this process. The next step should be to study graft engraftment with and without VAC including rate and time of engraftment and cost effectiveness.

## Conclusion

The VAC dressing after skin grafting provides good results. The area of the wound defect and the

number of days with VAC dressing influence on the outcomes of grafting. The risk of local progression is higher in patients with recurrent malignant skin tumors.

## References

1. Swetter SM, Tsao H, Bichakjian CK, Curiel-Lewandrowski C, Elder DE, Gershenwald JE, *et al.* Guidelines of care for the management of primary cutaneous melanoma. *J Am Acad* of *Dermatol.* 2019;80(1):208-50. <https://doi.org/10.1016/j.jaad.2018.08.055>  
PMid:30392755
2. Peris K, Fagnoli MC, Garbe C, Kaufmann R, Bastholt L, Seguin NB, *et al.* Diagnosis and treatment of basal cell carcinoma: European consensus-based interdisciplinary guidelines. *Eur J Cancer.* 2019;118:10-34. <https://doi.org/10.1016/j.ejca.2019.06.003>  
PMid:31288208
3. Yin Y, Zhang R, Li S, Guo J, Hou Z, Zhang Y. Negative-pressure therapy versus conventional therapy on split-thickness skin graft: A systematic review and meta-analysis. *Int J Surg.* 2018;50:43-8. <https://doi.org/10.1016/j.ijso.2017.12.020>  
PMid:29292216