

<https://doi.org/10.15407/exp-oncology.2023.03.364>

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PLASTIC SURGERY OF WOUND DEFECTS WITH FREE GRAFTS AFTER MALIGNANT SKIN TUMORS EXCISION: A PILOT STUDY

Aim. To evaluate the effectiveness of applying negative pressure bandages (VAC bandage) in patients with malignant skin tumors after closing defects with free skin grafts and to compare it with fixation of skin grafts by the ordinary ointment bandages. **Materials and Methods.** 61 patients with malignant skin tumors who underwent surgical treatment at the National Cancer Institute from 2019 to 2023 were included in the study. For the wound defects closure, the split skin grafts were applied in all patients. At the time of surgery, after closing a wound defect by a split skin graft, a negative pressure dressing (VAC bandage) was applied in 41 patients for 7 days (group 1). In 20 patients, a transplanted skin graft was fixed after surgery by an ordinary ointment pressure bandage (group 2). The immediate results were evaluated one week after surgery. **Results.** Complete engraftment of the flap in group 1 was observed in $53.7 \pm 7.8\%$ cases, in group 2 this result was achieved in $5.0 \pm 4.8\%$ patients ($p = 0.002$). The complete graft necrosis occurred in 1 case in group 1 vs. 2 cases in group 2 ($p = 0.496$). **Conclusion.** The results of the engraftment in postoperative wounds were significantly better in the VAC-bandage group in terms of the number of the complete engraftments compared to the conventional pressure ointment bandage group.

Keywords: skin malignant tumors, negative pressure bandage (VAC bandage).

Modern oncology widely uses surgery for the treatment of malignant skin tumors. Over the decades, indications and methods of skin tumor excision have changed. At the beginning of the 21st century, the main principle of skin cancer radical excision was a safety margin from the tumor border

to the edge of the resection. It is believed that the implementation of this rule leads to a decrease in the likelihood of local recurrence [1]. Depending on the tumor size and the histological type of skin cancer, the postoperative wound defects can reach tens and even hundreds of square centimeters.

Citation: Korovin S, Dedkov S, Ostafiichuk V, Kukushkina M. Plastic surgery of wound defects with free grafts after malignant skin tumors excision: A pilot study. *Exp Oncol*. 2023; 45(3): 364-369. <https://doi.org/10.15407/exp-oncology.2023.03.364>

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The problem of wound closing becomes particularly difficult in such anatomical areas as distal extremities and the scalp. Plastic surgery is constantly evolving and provides oncologists a wide range of options for closing large skin defects. One of the promising directions for wound closure is plastic surgery with free skin grafts (full-thickness and split grafts). A complicated issue of successful engraftment is a donor skin fixation to the wound bottom.

At the end of the last century, vacuum-assisted closure (VAC) bandages were proposed for the purulent wound treatment [2]. The method turned out to be quite effective and commonly used now in the surgery for the complicated wounds treatment. The idea of using such a technique as a method of fixing a free skin graft arose. It should be noted that the experience of using this modification was positive [3]. However, the application of this method in oncological practice is rare. In a meta-analysis, it was shown that a negative pressure in oncological surgery did not affect the recurrence rate [4].

Our clinic conducted a pilot study to evaluate the effectiveness of this method in the treatment of malignant skin tumors. The aim of the study was to evaluate the effectiveness of applying 78 negative pressure bandages (VAC bandage) in patients with malignant skin tumors after closing defects with free skin grafts compared to fixation of skin grafts by ordinary ointment bandages.

Materials and Methods

61 patients with malignant skin tumors who had surgical treatment at the National Cancer Institute from 2019 to 2023 were included in the study. For the wound defects closure, split skin grafts were applied in all patients. Depending on the postoperative wound management, patients were divided into two groups.

Study group 1 included 41 patients. At the time of surgery, a negative pressure dressing

(VAC bandage) was applied after closing the wound defect by a split skin graft. The duration of dressing was 7 days in 36 (87.8%) patients and 8 days in 5 (12.2%) patients.

VAC bandages with negative pressure (–80 mm Hg) were used in 9 (21.9%), with a pressure of –100 mm Hg in 11 (26.8%), and –120 mm Hg in 7 (51.3%) patients. In the case of an incomplete engraftment, no repeated attempts of transplantation were made, and the wounds were treated locally using the wound healing ointments.

Study group 2 involved 20 patients in whom skin grafts after tumor excision were fixed to the wound bottom with a conventional-pressure ointment bandage. The first change of the bandage was performed on the 8th day after surgery. Like in the previous group, there were no repeated attempts to transplant grafts, and all wounds were treated conservatively.

The area of the wound defect was calculated by the formula for determining the ellipse area ($S = \pi \times a/2 \times b/2$), where a is the length of the postoperative wound and b is its width.

The immediate result of the wound healing was evaluated after removing the bandage from the postoperative wound (on days 7–8 after surgery) based on the assessment of the visualized viable area of skin graft.

The descriptive statistics (mean (M) and standard deviation (SD) for quantitative indicators and data distribution in % for qualitative data) was used for statistical analyses. To compare quantitative parameters between groups, the Mann — Whitney test was done; to compare the frequency distributions of qualitative features, the Xi-square was tested.

Results

Our pilot study aimed at a primary assessment of effectiveness of VAC bandages was carried out with two groups of patients without strict requirements for their randomization. Therefore,

Table 1. Group characteristics according to sex, age, and wound defect area

Charac- teristics	Group 1 (VAC dres- sing)	Group 2	<i>p</i>
Sex			
Female	32 (78.1 %)	16 (80.0 %)	$p(x^2) = 0.891$
Male	9 (21.9 %)	4 (20.0 %)	
Average age (years)	59.2 ± 10.9	49.5 ± 11.2	$p(MW) = 0.002^*$
Average postope- rative defect area (cm ²)	48.1 ± 7.8	11.8 ± 7.2	$p(MW) < 0.001^*$

Notes: $p(x^2)$ — assessment by Xi-square; $p(MW)$ — evaluated by Mann — Whitney test; * difference is statistically significant ($p < 0.05$).

Table 2. Group characteristics by diagnoses and disease staging

Diagnoses and disease staging	Group 1 n (%)	Group 2 n (%)
Skin melanoma	31 (75.6 ± 6.7)	16 (80.0 ± 8.9)
St. IA	6 (14.6)	7(35.0)
St. IB	3 (7.3)	2 (10.0)
St. IIA	5 (12.7)	2 (10.0)
St. IIB	6 (14.6)	1 (5.0)
St. IIC	4 (9.8)	2 (10.0)
St. IIIA	—	1 (5.0)
St. IIIB	1 (2.4)	1 (5.0)
St. IIIC	5 (12.7)	—
St. IV	1 (2.4)	-
Squamous cell skin cancer	7 (17.0 ± 5.8)	2 (10.0 ± 6.7)
St. I	4 (9.8)	2 (10.0%)
St. II	2 (4.8)	—
St. III	1(2.4)	—
Basal cell skin cancer	3 (7.3 ± 4.0)	2 (10.0 ± 6.7)
St. I	1 (2.4)	2 (10.0%)
St. II	1 (2.4)	—
St. III	1 (2.4)	—
All:	41 (100)	20 (100)

Notes: Differences in the composition of groups according to diagnoses are insignificant, $p(x^2) = 0.738..$

we compared all general and clinical parameters of the patients to obtain grounds for preliminary conclusions (Tables 1—4).

The comparison of groups by the main characteristics is presented in Tables 1—4. The distribution of patients by sex was similar in both groups (Table 1). The age of the patients ranged from 22 to 86 years. It should be noted that the average age of patients in group 1 exceeded that in group 2 (Table 1).

The size of the postoperative wound defects varied widely: in group 1 — from 4 cm² to 659 cm²; in group 2 — from 1.3 cm² to 27.4 cm². On average, the size of postoperative wound defects was 4 times larger in group 1 than in group 2.

Table 2 provides a comparative description of two groups according to the histological type of tumor and disease staging. Both groups did not differ significantly in the type of skin malignancies; in most cases, patients with skin melanoma were operated.

Table 3. Group characteristics by anatomical localization of tumors

Anatomical localization	Group 1 n (%)	Group 2 n (%)
Lower limb	33 (80.5 ± 6.1)	14 (70.0 ± 10.2)
Thigh	1 (2.4)	—
Shin	14 (34.2)	3 (15.0)
Foot	18 (43.9)	11 (55.0)
Upper limb	3 (7.3 ± 4.0)	4 (20.0 ± 8.9)
Wrist	3(7.3)	4 (20.0)
Skin of head	3 (7.3 ± 4.0)	2 (10.0 ± 6.7)
Forehead	2 (4.8)	1 (5.0)
Parietal region	1(2.4)	—
Nose	—	1 (5.0)
Trunk	2 (4.8)	—
Back	1(2.4)	—
Buttock	1(2.4)	—
All	41 (100)	20 (100)

Notes: Differences in the composition of groups according to diagnoses are insignificant, $p(x^2) = 0.366$.

When considering the prevalence of the tumor spreading, the fact of a poorer oncological prognosis among patients of group 1 should be also taken into account.

Table 3 presents the data on the anatomical localization of neoplasms. The main affected area was the limbs, especially the lower ones.

The concomitant diseases that were present at the time of surgical treatment were more common among patients in group 2 (Table 4).

We evaluated an immediate result of wound healing after removing the bandage from the postoperative wound on days 7–8 after surgery.

Table 5 demonstrates a comparative analysis by the engraftment area indicator. There is a clear benefit of VAC dressing. Complete engraftment in group 1 was observed in $53.7 \pm 7.8\%$ cases, while in group 2, engraftment was achieved in $5.0 \pm 4.8\%$ of patients. In group 1, engraftment $> 50\%$ of graft area was recorded in $85.6 \pm 5.4\%$ of patients, while in group 2 — in $70.0 \pm 10.2\%$ of patients. The difference in the frequency of complete graft necrosis between the groups was insignificant (Table 5).

A case report of the VAC dressing application for the treatment of squamous cell skin cancer in

a patient with comorbidities is presented below. Patient P., female, 76 years old, came to the National Cancer Institute in April 2021 complaining of a skin ulcer on the right shin. The problem has been there for over a year. The patient has a lot of concomitant diseases: varicose disease of the lower extremities, coronary heart disease, diffuse atherosclerosis, arterial hypertension. After biopsy, a diagnosis of squamous cell carcinoma was confirmed by a pathology report.

On May 05 2021, the patient was operated, wide excision of the skin tumor on her right shin with split skin grafting and a VAC bandage were conducted. The consecutive stages and the result of the treatment are shown in the Figure.

Discussion

The closure of wound defects after excision of malignant skin tumors remains a difficult problem in current dermatology. The area of postoperative wounds can reach hundreds of square centimeters. It is possible to eliminate such defects in complex anatomical areas with free graft transplantation techniques [5]. For ef-

Table 4. Group characteristics by comorbidities

Diagnoses and disease staging	Group 1 n (% of all group)	Group 2 n (% of all group)
Diabetes mellitus	3	2
Cardiac ischemia	1	2
Arterial hypertension	4	2
Autoimmune thyroiditis	—	2
Thyrotoxic goiter	—	1
Parkinson's disease	1	—
Schizophrenia	1	—
Deforming arthrosis	1	—
All	11 ($26.8 \pm 6.8\%$)	9 ($45.0 \pm 11.1\%$)

Notes: Differences in the composition of groups according to diagnoses are insignificant, $p(x^2) = 0.156$.

Table 5. Comparative assessment of the engraftment of the donor graft

% of engraftment area	Group 1 n (%)	Group 2 n (%)	<i>p</i>
100	22 (53.7 ± 7.8)	1 (5.0 ± 4.8)	0.0002*
90	4 (9.6)	2 (10.0)	0.649
80	3 (7.2)	6 (30.0)	0.028*
70	3 (7.2)	2 (10.0)	0.999
60	1 (2.4)	1 (5.0)	0.999
50	2 (4.8)	2 (10.0)	0.592
40	1 (2.4)	1 (5.0)	0.999
20	1 (2.4)	3 (15.0)	0.198
10	3 (7.2)	—	—
0 (complete necrosis)	1 (2.4)	2 (10.0)	0.496
All	41 (100 %)	20 (100 %)	—

Notes*: Differences are statistically significant ($p < 0.05$).

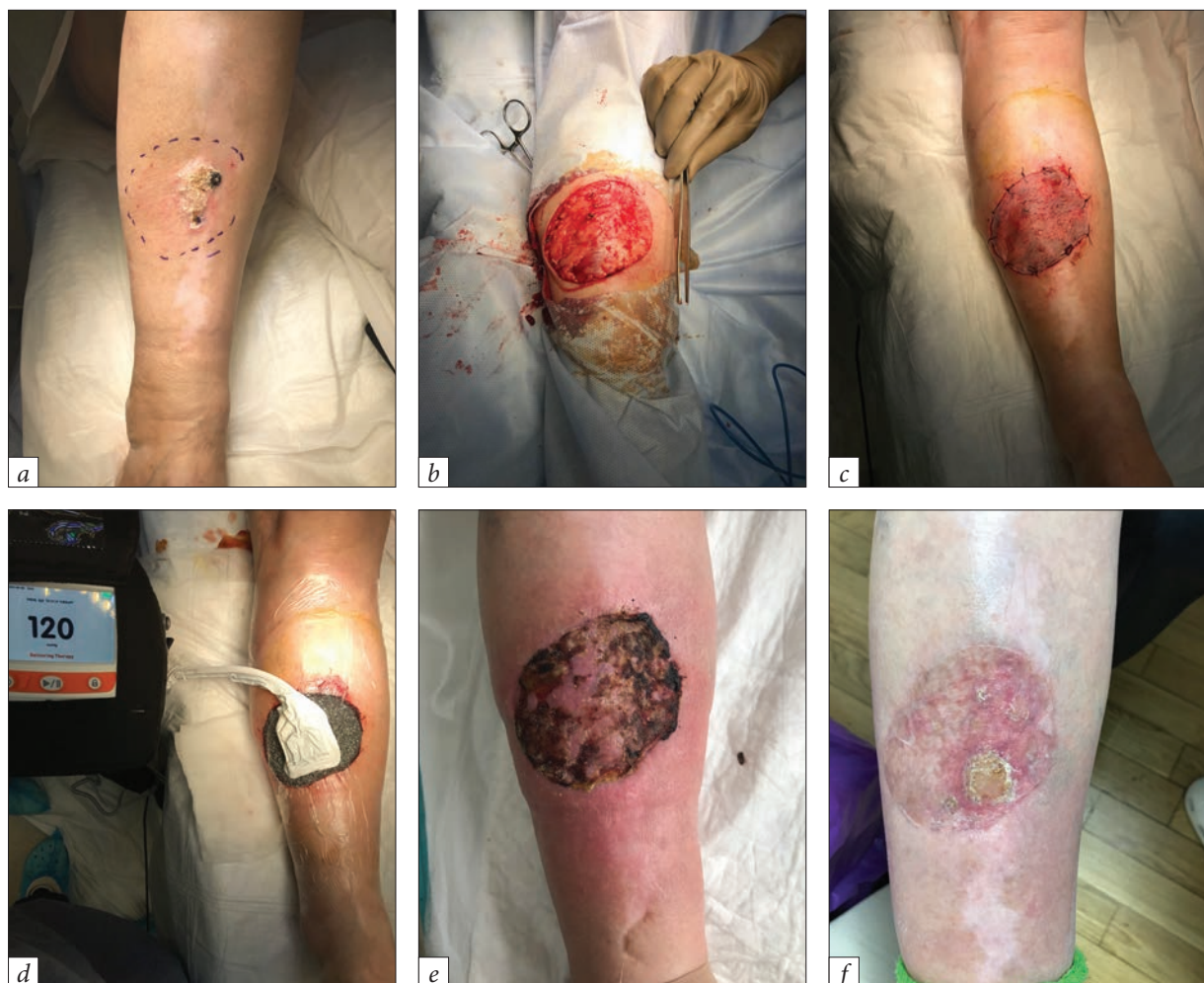


Fig. 1. Consecutive stages and the result of treatment of squamous cell carcinoma with wide excision, split skin grafting, and a VAC bandage: *a*) tumor before the surgery; *b*) the first stage of the surgery after tumor excision; *c*) the second stage of the surgery after closing the wound defect with a split skin graft; *d*) the third stage of the surgery after the application of a VAC bandage; *e*) postoperative wound on day 7 after the removal of the VAC bandage; *f*) follow-up examination after 6 months

fective engrafting to the wound bottom, good fixation of the donor skin is necessary.

Bandages with the negative pressure are widely used in surgical practice [6]. Most often, such methods are used to heal complex purulent wounds, but according to some literature data, it seems reasonable to fix free skin grafts to the bottom of postoperative wounds [7].

In our pilot study, we conducted a comparative analysis of two methods of managing postoperative wounds in patients after wide excision

of malignant skin tumors. The immediate results of applying a bandage with negative pressure and an ordinary ointment bandage were evaluated.

Comparing two groups of patients, who were distributed according to the treatment of postoperative wounds, the following was established. Age, sex, and diagnosis with which the patients came to the clinic were comparable in both groups as well as anatomical localization of skin tumors. Concomitant chronic diseases occurred more often among patients of group 2 than

among patients of group 1, however the difference was insignificant. There are reasons to argue that the initial chances of a good result were higher in patients of group 2. The area of wound defects in group 1 significantly exceeded that in group 2, which led to complicated engrafting of the donor graft ($p < 0.001$).

In a comparative evaluation of engrafting free dermal flaps, a reliable advantage of using bandages with negative pressure was established. Thus, it seems reasonable to consider such a method of fixation of free graft after excision of malignant skin tumors as promising practice in modern dermatology-oncology.

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Submitted: July 25, 2023

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ПЛАСТИКА РАНОВИХ ДЕФЕКТІВ ВІЛЬНИМИ ДЕРМАТОМНИМИ КЛАПТЯМИ ПІСЛЯ ВИДАЛЕННЯ ЗЛОЯКІСНИХ НОВОУТВОРЕНЬ ШКІРИ: ПІЛОТНЕ ДОСЛІДЖЕННЯ

Мета. Провести оцінку ефективності застосування методики накладання пов'язки з негативним тиском (VAC пов'язка) у хворих на злоякісні новоутворення шкіри після закриття дефектів вільними шкірними клаптями і порівняти її з фіксацією шкірних клаптів звичайними мазевими пов'язками. **Матеріали та методи.** До дослідження включено 61 хворого, яким у клініці Національного інституту раку з 2019 по 2023 рік проводилося хірургічне лікування злоякісних новоутворень шкіри. Для закриття ранових дефектів усім хворим застосовано методику пластики вільним розщепленим шкірним клаптем. Під час операції після закриття дефекту дерматомним клаптем 41 хворому накладалася пов'язка з негативним тиском (VAC пов'язка) на 7 діб (група 1). 20 хворим пересаджено шкірний клапоть фіксувався після операції звичайною мазевою пов'язкою (група 2). Безпосередні результати оцінювалися через тиждень після операції. **Результати.** Повне приживлення клаптя у групі 1 спостерігалось у $53,7 \pm 7,8\%$ випадків, у групі 2 цей результат досягнуто в $5,0 \pm 4,8\%$ хворих ($p = 0,002$). Повний некроз клаптя у групі 1 мав місце в 1 випадку, а в групі 2 — у двох випадках ($p = 0,496$). **Висновки.** Використання пов'язки з негативним тиском при закритті післяопераційної рани дерматомним клаптем має перевагу в порівнянні з методикою ведення післяопераційних ран звичайними мазевими пов'язками.

Ключові слова: злоякісні новоутворення шкіри, пов'язка з негативним тиском (VAC пов'язка).