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ТЕРАПИЯ РАН ОТРИЦАТЕЛЬНЫМ ДАВЛЕНИЕМ: ПОКАЗАНИЯ И ОСОБЕННОСТИ ПРОВЕДЕНИЯ У ПАЦИЕНТОВ С ОЖОГАМИ

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Резюме. Положительное влияние вакуума на течение раневого процесса у пациентов с ожогами обусловлено бактериальной деконтаминацией, усилением локальной перфузии, неоангиогенезом, сохранением влажной раневой среды, снижением интенсивности болевого синдрома и другими механизмами. Однако во многих случаях решение о применении метода вакуумной терапии для лечения пациентов с ожогами принимается не на основании объективных причин, а исходя из личного опыта и предпочтений врачебного персонала. В наше исследование был включен 91 пациент отдела термических поражений, которым проводилась вакуумная терапия ран в период с 2017 по 2021 г. В зависимости от клинической ситуации все пациенты были разделены на четыре группы: лечение пограничных ожогов или донорских ран, временное закрытие операционных ран после выполнения некрэктомий или атипичных ампутаций, стимуляция роста грануляционной ткани, фиксация кожных трансплантатов. Наибольший положительный эффект от проведения вакуумной терапии мы наблюдали у пострадавших с дефицитом донорских ресурсов, при лечении ожогов II степени, при подготовке к выполнению кожной пластики на ранах со сложной анатомической структурой. Количество противопоказаний к применению данного метода оказалось минимальным, осложнения наблюдались редко. Таким образом, эффективность вакуумной терапии у обожженных значительно превышает потенциальные риски данного метода.

Ключевые слова: ожоги; ожоговая болезнь; раны; NPWT; вакуумная терапия.

NEGATIVE PRESSURE WOUND THERAPY: INDICATIONS AND FEATURES OF TREATMENT IN BURNED PATIENTS

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Abstract. The positive effect of vacuum on the wound process in burned patients is due to bacterial decontamination, increased perfusion, neoangiogenesis, preservation of a moist wound environment, reduced pain intensity, and other mechanisms. However, in most cases, the indications for the use of vacuum in burnt patients do not depend on objective reasons, but on personal experience and preferences of the medical staff. The study included 91 patients of the burn department who underwent NPWT from 2017 to 2021. All these patients were divided into four groups: wound treatment,

temporary wound closure, granulation formation, fixation of skin grafts. The greatest positive effect from NPWT can be expected in patients with a shortage of skin graft donor sites, in the treatment of deep partial-thickness burn, in preparation for skin graft of “problem” wounds. The number of contraindications to the use of vacuum in burnt patients is minimal, and complications are rare. Thus, the effectiveness of NPWT in burned patients significantly exceeds the possible disadvantages.

Key words: burns; severe burns; wounds; NPWT; VAC-therapy.

BACKGROUND

Burn wounds account for about 2.5% of the total structure of injuries. Surgical treatment of burn patients is largely a creative process, since there are no clinically sound recommendations for choosing one or another method of local treatment of burns. One of the promising methods of treating various wounds, including burn wounds, is negative pressure wound therapy (NPWT). The positive impact of negative pressure on the wound healing is mediated by several mechanisms. These include bacterial decontamination, increased perfusion in the wound and paraulnar tissues, neoangiogenesis, maintaining a moist wound environment, reducing the intensity of pain and itching, etc. [3, 4, 11].

The methodology, indications and contraindications for the use of NPWT in surgery, orthopedics and diabetic foot syndrome are quite clearly formulated in the form of clinical recommendations [3, 5, 6, 9]. At the same time, publications on the use of NPWT in patients with burns are more often retrospective reports on series of cases [7, 8, 10, 12, 13]. Due to the lack of clinical recommendations, the technique of NPWT in burn patients largely depends not on objective reasons, but on personal experience and preferences of medical staff. To accumulate a sufficient number of clinical observations in medical databases, we continued the previously started study [1].

The goal of the study was to analyze the results of the use of NPWT in patients with burn injuries.

MATERIALS AND METHODS

We analyzed the cases of 91 patients who were treated in the burn department of the Institute of Emergency Care named after. I.I. Dzhanelidze in 2017–2021. All completed cases treated with negative pressure therapy were included in the study.

In all patients, Venturi Avanti devices (Talley Group Ltd., UK) were used for NPWT. The wound cavity was filled with a sterile polyurethane Foam Pad (Talley Group Ltd., UK), Kendall Kerlix AMD pads (Tyco Healthcare Group LP, USA), or a combination of both. The wound was sealed with an adhesive film. For drainage we using channel silicone or portal plastic drainage. The level of negative pressure, depending on the clinical situation, was regulated from 50 to 125 mm Hg. Dressings were changed every 1 to 5 days.

RESULTS

During the study period (2017–2021), 173 NPWT sessions were performed in 91 patients. One patient underwent an average of 1.9 therapy sessions, the average duration of the course was 5.7 days. 68 of 91 (75%) patients were treated in the burn intensive care unit at the time of NPWT initiation, the remaining 23 were in the burn department. The age of the patients ranged from 20 to 90 years, the median age was 49 (40; 59) years. The average value of the area of burns was 18 (8.5; 32)% TBSA, full thickness burns — 8 (5; 19.5)% TBSA. A continuous therapy was used in 47 (52%) patients, intermittent therapy — in 32 (35%), mixed (continuous, then intermittent) — in 12 (13%) patients.

During the use of the technique, we encountered three main reasons for refusing to use NPWT — clinically significant coagulopathy, localization of the great vessels in the bottom of the wound, and severe cognitive impairment. In four patients, we observed episodes of bleeding from burn wounds, which required an emergency discontinuation of therapy. Technical difficulties that required correction or change of previously applied dressings were much more common — in 15 out of 91 patients (16%). Depending on the indications for NPWT, all the patients were divided into four groups: wound treatment, temporary wound closure, formation of granulation tissue, fixation of skin grafts.

Treatment of wound defects

Split thickness burns after surgical debridement are similar to donor wounds - in both cases, the remaining tissues provide self-healing of such wounds. The use of NPWT in the treatment of split thickness burns reduces the likelihood of complications and stimulates regeneration, thereby reducing the time of treatment of patients. When there is a shortage of donor sites, NPWT helps to minimize the time between repeated graft from one donor site, or to quickly prepare an area with split thickness burns for skin graft sampling [2].

We used NPWT to treat such wounds in 19 patients. Dressings were changed at intervals of 3–5 days. With equal success, both continuous and intermittent therapy with a pressure level of 100–125 mm Hg were used.

Temporary closure of wounds

The optimal treatment for full thickness burns is early excision with simultaneous skin grafting. However, we were not always able to achieve radicalness during excision. The use of NPWT in such cases contributed to increased perfusion and stimulation of neoangiogenesis in the remaining tissues. Another variant of the application of the NPWT was the closure of wounds formed after performing atypical “guillotine” amputations of the limbs. This

made it possible to maintain the required length of the stumps and sanitize tissues of dubious viability, followed by delayed skin graft of its end. Also, in some patients, we performed NPWT for the purpose of debridement after excision of complicated burns or chemical burns. NPWT for temporary wound closure was used in 28 patients. Most often, short-term therapy sessions were used in a constant mode at a pressure of 60 to 100 mm Hg.

Formation of granulation tissue

The degree of engraftment of skin grafts is associated with the readiness of the recipient wound, which is most often represented by granulation tissue. In some elderly patients, as a result of treatment, we were unable to achieve the formation of high-quality granulation tissue, which did not allow us to perform skin grafting in the optimal time frame. The prolonged existence of such wounds is accompanied by increased losses of protein and electrolytes. A solution to this problem was to stimulate the formation of granulation tissue with NPWT, which we performed in 30 patients. In all cases, intermittent treatment was used with a pressure level of 60 to 100 mm Hg. The duration of one session was from 3 to 5 days. In 22 out of 30 patients, the use of this method made it possible to subsequently perform skin grafting with good engraftment results. As a side effect of this treatment, we observed a gradual decrease in the area of the wound due to retraction of the edges.

Fixation of skin grafts

With well-prepared wounds, complete engraftment of skin grafts is observed in more than 90% of cases. Additional fixation of skin grafts using NPWT may be required when performing skin grafting in areas with high mobility (joints, hands, feet), areas with complex relief (face, axillary region, interdigital spaces), with technical difficulties with external fixation (circular lesions), with poor quality of recipient wounds, etc. According to some data, the skin, formed after engraftment of vacuum-fixed skin grafts, has higher characteristics in terms of elasticity and cosmetics. We applied additional fixation with vacuum in 14 patients. In 11 cases, we used non-meshed skin grafts, in 3 cases, meshed grafts. All patients underwent one session of continuous therapy with a pressure of 60–80 mm Hg. In all 14 cases, engraftment of more than 90% of the area of skin grafts was observed.

Technical features of the use of NPWT in burned patients

The peculiarity of applying vacuum dressings in patients with burns is that almost always the wound is located at the level of surrounding tissues. Accordingly, significant volumes of relatively thin porous material had to be used to fill such wounds. In many patients, several sponges were used simultaneously, which, for convenience, were fixed to each other, to the bottom of the wound or to the surrounding skin using interrupted sutures or

Table 1

Recommendations for choosing the mode of vacuum therapy

Indication	Clinical situation	Therapy mode	Vacuum level, mm Hg	Dress change frequency, days
Treatment of wounds	Split thickness burns	Continuous or intermittent	100–125	3–5
	Donor sites	Continuous	100–125	3–5
Temporary closure of wounds	Non-radical excision	Continuous	60–100	2–4
	Atypical amputation	Continuous or intermittent	60–80, then 80–100	2–4
	Complicated burns	Continuous	80–120	1–2
	Chemical burns	Continuous	80–120	1–2
Formation of granulation tissue	Elderly patients	Intermittent	60–100	3–5
	Treatment of pressure ulcer	Intermittent	80–100	3–5
Fixation of skin grafts	Split thickness skin graft	Continuous	60–80	5–7
	Full thickness skin graft	Continuous	60–80, then 80–100	5–7

metal brackets. If the area of the wound exceeded 10% of TBSA, then two NPWT devices were used simultaneously to create a uniform vacuum, which were connected through separate ports at the same distance from each other. In several patients with extensive burns, we managed to divide large wounds into several smaller ones using skin grafting in the form of wide "bridges" in such a way that it would be more convenient to seal the remaining wounds in the future.

This method was also used for small burns. There were cases in which any part of the wound edge prevented the achievement of tightness. Such cases arose when the wound bordered on the natural openings of the body, areas with a complex anatomical structure, etc. The solution was skin grafting of the problem area of the wound. At the same time, already 7–10 days after the grafting, it was possible to fix the adhesive film on the engraftment skin graft without fear of negative consequences. In such observations, we used thicker (0.4–0.5 mm) non-meshed skin grafts.

In the treatment of patients with several wounds located next to each other, so-called "bridges" were used. Each wound was covered with a sponges and sealed independently of each other, after which the intact skin between the wounds was also covered with a film. After that, a small hole was made above the center of each wound and they were connected to each other using a "bridge" made of a porous sponge. Next, the formed bridge was recovered with a film, and an aspiration port was formed in its center.

The technique of applying vacuum dressings in patients with burns has certain specific features. In surgery and orthopedics, more often one has to deal with wounds that require a thick sponge to fill. Burn patients almost always have large "flat" wounds that require thinner material to fill. When it is difficult to seal the wound, it is almost always possible to optimize the contour of the edges with skin grafting or to divide a large wound into several smaller ones. Recommendations for selecting the mode and duration of therapy sessions are presented in table 1.

CONCLUSION

Vacuum therapy is used in patients with burns with a limited list of indications. The greatest positive effect from NPWT can be expected in patients with a shortage of donor sites, in the treatment of split thickness burns, in preparation for skin graft of "problem" wounds. At the same time, the number of contraindications to the use of vacuum in burnt patients is minimal, and complications are rare. Thus, the effectiveness of NPWT in burned patients significantly exceeds the possible disadvantages.

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