

Experience of Using NPWT Therapy in the Treatment of Combat Injuries of Soft Tissues

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Abstract. *Aim.* NPWT therapy (Negative-Pressure Wound Therapy) or VAC therapy (Vacuum-Assisted Clousure) – a modern method of wound healing, which significantly improves the course of all stages of the wound process and is relevant today due to the large number of wounded during hostilities in eastern Ukraine. Often these injuries are combined and lead to the formation of large soft tissue defects. *The aim of the study.* Improving the results of treatment of the wounded with extensive defects of the soft tissues of the torso and extremities through the use of NPWT therapy. *Materials and methods.* Under our supervision in the period from 2017 to 2023 there were 60 wounded who were hospitalized in the surgical departments of the Military Medical Clinical Center of the Southern Region, who received vacuum therapy in the treatment of wounds. 63.3% had gunshot wounds to the extremities, and 36.7% had soft tissue injuries to the torso. The age of the wounded ranged from 19 to 58 years, among them young people under 30 years of age. Before installing the device, it was necessary to perform surgical treatment with excision of necrotic tissue and removal of fibrin layers. Negative pressure was set at –125 mmHg (arterial) in the non-stop mode for soft tissue defects of the extremities and variable pressure in the –40 mmHg (arterial) mode; –70 mmHg (arterial) for wounds of the anterior abdominal wall. The duration of treatment with NPWT therapy was from 5 to 25 days. The systems were replaced at least once every 3–5 days. Criteria for discontinuation of NPWT therapy were: cleansing the wound of necrotized tissues and fibrin, improving clinical performance, filling the wound defect with granulation tissue. *Results and discussion.* The use of this method of treatment allowed to close wound defects by autodermoplasty in 35% patients, primary-delayed sutures in 18%, secondary sutures in 25% and local tissue plastics in 22%. Complications after NPWT therapy in the form of re-suppuratation of the wound, bleeding or perforation of

Received: 2025-08-18. **Accepted:** 2025-09-21.

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hollow organs and large vessels were not observed. *Conclusions.* The use of NPWT therapy can significantly increase the effectiveness of comprehensive treatment of the wounded with damage to the soft tissues of the torso and extremities. It allows you to quickly clean the wound surface, fill the wound defect with granulation tissue and prepare the wound for plastic closure.

Keywords: gunshot wounds, soft tissue defects, VAC therapy.

Introduction

Today, the issues of surgical treatment of combat injuries and their consequences remain one of the most important in military surgery. Modern combat surgical trauma is gunshot bullet and shrapnel wounds, explosive trauma, non-gunshot injuries from secondary fragments and combined injuries from various types of weapons [1].

Damage to the limbs and trunk, leading to the formation of soft tissue defects, accounts for 34.6–40.1% of the sanitary losses of the surgical profile [2]. To date, closing a tissue defect of any localization remains a difficult problem in reconstructive surgery [3]. On the one hand, quick closure of the tissue defect is required to prevent complications and restore the function of the damaged area as fully as possible, on the other hand, the readiness of the wound for closure is a determining factor [4, 5].

NPWT therapy (Negative-Pressure Wound Therapy) or VAC therapy (Vacuum-Assisted Closure) is a modern method of wound treatment that significantly improves the course of all stages of the wound process and is relevant today due to the large number of wounded during the war in Ukraine. Often these injuries have a combined nature and lead to the formation of large soft tissue defects [6, 7].

The aim

Improving the results of treatment of wounded patients with extensive soft tissue defects by using NPWT therapy.

Materials and methods

The method of applying NPWT consists in using the principles of local negative pressure (topical negative pressure – TNP), that is, in creating a stable vacuum in the wound cavity by installing a system for active aspiration, which in turn reduces the level of wound exudation, helps to maintain a moderately moist wound environment, which is necessary for the normal course of reparative and regenerative processes, reduces local swelling, strengthens local blood circulation and reduces the level of microbial contamination. These effects contribute to an increase in cell proliferation, increase the synthesis of the main substances of connective tissue and proteins in the wound, which leads to a relatively rapid reduction of the wound cavity and shortens the time for closing the wound defect.

The formation of the system is carried out by placing a polyurethane sponge in the surgical wound, sealing the wound with a transparent adhesive film, which is pasted on the outside of the sponge and on the skin of the edges of the wound. A drainage tube with a film-applicator is installed on the bandage created in this way, which hermetically connects this bandage with the device, which ensures the effect of negative pressure on the bandage and the wound.

Under our observation in the period from 2017 to 2023, there were wounded who were undergoing inpatient treatment in the surgical departments of the Military Medical Clinical Centre of the Southern Region, who were treated with vacuum therapy. 63.3% of them had gunshot wounds to the limbs, 36.7% wounds to the soft tissues of the body. The age of the wounded ranged from 19 to 58 years old, and among them the majority were young people under 30 years old.

All the injured were brought from other medical institutions within 3 to 22 days from the moment of receiving the injury after the surgical treatment of the gunshot wounds carried out by them, in view of this, all their wounds were infected. During the first installation of a vacuum bandage, exudate was collected from the wound cavity for further bacteriological examination in order to determine sensitivity to antibacterial drugs.

Smith and Nephew (Renasys Touch) and HEACO NP32 devices were used. Both devices have a battery that allows you to use the device without constant power supply. The dimensions of the wound defects ranged from 5.2 cm to 39.0 cm. Before the installation of the device, surgical treatment with excision of necrotic tissues and removal of fibrin layers was mandatory. The negative pressure was set at the level of -125 mmHg (arterial) in non-stop mode for defects of soft tissues of the limbs and variable pressure in the mode of -40 mmHg (arterial) (5 min), -70 mmHg (arterial) (10 min) for wounds of the anterior abdominal wall.

All patients were given complex antibacterial therapy, taking into account the sensitivity of the pathogenic microflora of the wound, which was determined during the bacteriological examination, as well as adequate drug treatment, which was aimed at maintaining the functional state of the main organs and functioning systems of the body, taking into account the individual characteristics of the course of the wound process.

The term of treatment with the help of NPWT therapy was from 5 to 25 days, depending on the size of the defect, localization of the wound, the age of the patient and the presence of concomitant diseases. Systems were replaced at least once every 3–5 days. In most of the wounded, such replacements were carried out three times. The criteria for stopping NPWT therapy were: cleaning of the wound from necrotic tissues and fibrin, improvement of clinical indicators, filling of the wound defect with granulation tissue.

The results

In all cases, the wounds were ready for closure 8–15 days after the start of negative pressure treatment. Closure of the wound defect was carried out: primary delayed suture, secondary early and late suture, local tissue plastic and autodermoplasty.

The application of the indicated method of treatment made it possible to close wound defects by means of autodermoplasty in 35% of patients, primary and delayed sutures in 18%, secondary sutures in 25%, and plastics with local tissues in 22%.

Complications after NPWT therapy in the form of repeated suppuration of the wound, bleeding or perforation of hollow organs and large vessels were not observed.

Discussion of research results

Most often, autodermoplasty was used as a method of final wound closure in combat trauma (35%), the second in the observation group was the method of secondary sutures (25% of cases), this distribution is due to the fact that the use of NPWT even in cases of infected wounds allows effective prevention development of purulent infection. It is important to note the regularity between the location of the lesion and the method of closing the wound defects.

In all patients, wound closure was performed within 15 days. Patients with defects of the anterior abdominal wall who had purulent-septic complications against the background of injuries to the hollow organs of the abdominal cavity were treated for the longest time.

The use of NPWT therapy made it possible to reduce the time of treatment of the wounded in the limb by 2.3 times due to the rapid cleansing of the wound and the development of granulation tissue. This, in

turn, accelerated the terms of secondary wound closure and stump formation and favourably influenced faster prosthetics and recovery. Wound healing in a shorter time after injury contributed to less muscle atrophy and the start of physiotherapy at an earlier date.

It should be noted that the presence of a cleaner wound due to the constant aspiration of infected wound discharge led to a significant (3.4 times) decrease in purulent-septic complications, which in turn reduced the amount and duration of antibiotic therapy and the development of resistance to these drugs. The use of small-sized devices allowed the wounded not to lose their mobile activity, which was especially pronounced when several limbs were injured at the same time.

Early terms and quality of recovery after prosthetics allowed more than 65% of the wounded to return to duty within a year.

Conclusions

The use of NPWT therapy allows to significantly increase the effectiveness of the complex treatment of the injured with damage to the soft tissues of the body and limbs. It allows you to quickly clean the wound surface, fill the wound defect with granulation tissue and prepare the wound for plastic closure.

Authors contribution

Karen Muradian – conceptualization, methodology.

Mykhailo Kashtalian – formal analysis, investigation.

Ievgen Kvasnevskyi – writing (original draft), visualization.

Oleksandr Kvasnevskyi – writing (review and editing).

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