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Clinic case

# Sistema de presión negativa como tratamiento de la ventana torácica: informe de un caso

# Negative Pressure System as a Thoracic Window Treatment: a Case report

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## Resumen

**Introducción:** Se presenta un caso clínico de sistema de presión negativa como tratamiento de ventana torácica derecha, realizado en la clínica de heridas. Se describe el tiempo y proceso de cicatrización, desde la llegada del paciente hasta la cicatrización total.

**Caso:** Hombre de 24 años, postoperado de toracotomía, se le colocó terapia de presión negativa inicial a -75mmHg con intensidad media y modalidad continua; se aplicó esponja blanca para proteger el pulmón expuesto y esponja de plata, con tres cambios cada siete días. Posteriormente, se realizaron diez cambios de esponjas cada cuatro días, identificando disminución de las dimensiones de la ventana torácica. En la semana once inició tratamiento con terapia húmeda y fibrina rica en plaquetas, la cual se colocó en el lecho de la herida, aplicándose una vez por semana durante un mes. A partir de la semana quince se realizó curación diaria con aplicación de sulfadiazina de plata. El paciente fue dado de alta en la semana veinte con la herida 100% epitelizada.

**Conclusiones:** El uso de la terapia de presión negativa acelera el proceso de curación, reduce las complicaciones y la carga bacteriana del tejido, debido a que la esponja de plata actúa como barrera antimicrobiana.

**Palabras clave:** terapia de heridas con presión negativa; curación de heridas; técnicas de cierre de heridas; cuidado de enfermería; toracotomía; ventana torácica.

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## Abstract

**Introduction:** A clinical case of negative pressure system as a right thoracic window treatment, performed in the wound clinic, is presented. The time and healing process from patient arrival to complete healing is described.

**Case:** A 24-year-old man, postoperative thoracotomy, was placed on negative pressure therapy at -75mmHg with medium intensity and continuous mode; white sponge was applied to protect the exposed lung and silver sponge, with three changes every seven days. Subsequently, ten sponge changes were performed every four days, identifying a decrease in the dimensions of the thoracic window. In week eleven, the patient started treatment with wet therapy and platelet-rich fibrin, which was placed in the wound bed and applied once a week for a month. From week fifteen onwards, daily healing was performed with silver sulfadiazine application. The patient was discharged at week twenty with the wound 100% epithelialized.

**Conclusions:** The use of negative pressure therapy accelerates the healing process, reduces complications and tissue bacterial load, due to the silver sponge acting as an antimicrobial barrier.


**Keywords:** negative pressure wound therapy, wound healing, wound closure techniques, nursing care.

## Background

The thoracic window is the opening of the chest wall and is used to drain the accumulation of pus in the space between the lung and the inner surface of the chest wall, also known as pleural or thoracic empyema.[1,2] In most cases it is the result of an unresolved parapneumonic pleural effusion, most often caused by pneumonia.[3] There are two types of thoracotomy, open and closed. Open thoracotomy or thoracic window is used when the empyema is chronic and treatment methods have failed, while in closed thoracotomy the pus can be drained through a tube inserted into the pleural cavity.[4]

In this situation, negative pressure therapy (NPT) is considered, which is defined as the application of controlled subatmospheric pressure to a wound; it consists of an advanced treatment with a non-invasive system that works actively using an electric pump, and is intended to facilitate the healing process.[5,6] It consists of a porous polyurethane sponge that is connected to a vacuum pump and fixed with an adhesive dressing around the wound.[7] This system improves blood flow over the wound area, accelerating the appearance of granulation tissue, filling spaces, or providing an appropriate vascular bed, while at the same time eliminating wound exudate, controlling the possibility of bacterial superinfection.[7,8]

The mechanism of action is based on reducing edema, exudate, cellular detritus and inflammation. It controls the bacterial load, improves blood and lymphatic flow, increases the formation of neovascularization and, therefore, of granulation

tissue, as well as increasing the action of growth factors, which are its main points of intervention.[9,10,11] Because of this, the thoracic window requires specific and specialized nursing care, which has evolved from the use of honey to the use of the latest generation of alginates and the management of NPT, in addition to care in the removal of non-vascularized tissue.[12,13]

In this way, both the patient and family are provided with information about wound care to identify any abnormalities, and the wound care nurse takes care of all system management, examines skin changes, pain, bleeding, odor, infection, system leakage, and wound evolution, as well as sponge changes, pressure intensity, and healing material replacement.[14,8] NPT has been widely used in the area of plastic surgery, abdominal surgery, orthopedics and cardiothoracic surgery.[11]

The present study was performed to improve the process of thoracic window closure, which depends on the patient's clinical conditions, previous complications, and wound characteristics. Therefore, the aim of the research was to evaluate the effect of NPT as a chest window treatment in a post-surgical patient managed in the wound clinic.

## Case description

The case of a patient who underwent appendectomy and laparotomy due to the formation of collections is presented. After the surgical event he presented torpid evolution and massive right pleural effusion, for which a right endopleural tube was placed, which was removed after two days due to an abdominal abscess with purulent fluid outflow. The patient was then referred to the institution for thoracotomy and reintervention for residual abdominal abscesses, resulting in two wounds. One week after the thoracotomy, he presented pleural effusion and purulent exudate, so NPT was placed in the thoracic window, which presented a volume of 805 cm3 (Figure 1) and moderate serous exudate. White sponge was placed to protect the exposed lung and silver sponge, with initial pressure at -75mmHg, medium intensity and continuous mode.

Figure 1. Thoracic window.

### Anamnesis

Male patient, 24 years old, originally from Oaxaca, resident of the State of Mexico, living in a house made of durable materials and with all services. He has a primary school education, working occupation, marital status in free union, Christian religion, negative zoonosis and unknown vaccination schedule. He also has a surgical history of appendectomy and exploratory laparotomy, and refers a nasal fracture 6 months ago with conservative treatment. Allergies, transfusions, drug addictions and infections are denied.

### Medical diagnoses

The patient was found with a series of complications, such as: pulmonary parenchyma with consolidation of the apicoposterior segment of probable infectious etiology (co-rads 2), laminar left pleural effusion with passive atelectasis and ipsilateral sub-segmentations, collection of the loculated right pleural space with reinforcement of its walls and gas inside (empyema) and two loculi of larger size, one anterior and one posterior, producing passive atelectasis of the whole lung, with displacement of the mediastinum to the left of the midline and pleural effusion in conditions classified elsewhere.

### Treatment and evolution: continuity of care

From the third week onwards, the patient presented a moderate amount of serous exudate with three sponge changes every 7 days; also, the negative pressure parameters were modified to -25mmHg due to risk of bleeding. The pressure was gradually increased to -75mmHg because the wound did not show bleeding data (Figure 2).

Figure 2. Thoracic window without bleeding data

In the fourth week, granulation tissue was observed in the wound, the stitches were removed and the negative pressure was increased to -100mmHg with instillation of hypochlorous acid-based antiseptic, placing 50 ml every 6 hours. Three days later, five lesions were visualized in perilesional skin suture sites (Figure 3).

Figure 3. Suture site lesions (perilesional skin)

In week five, instillation with 40 ml of hypochlorous acid cleaning solution was applied. From week six onwards, ten sponge changes were performed every 4 days, identifying a decrease in the dimensions of the thoracic window.

After two months of NPT use, the wound presented measurements of 1cm wide, 1cm long, 1cm deep and 5cm of undermining. For the thirteenth sponge change negative pressure was applied at -125mmHg, which was the last NPT placement (Figure 4).

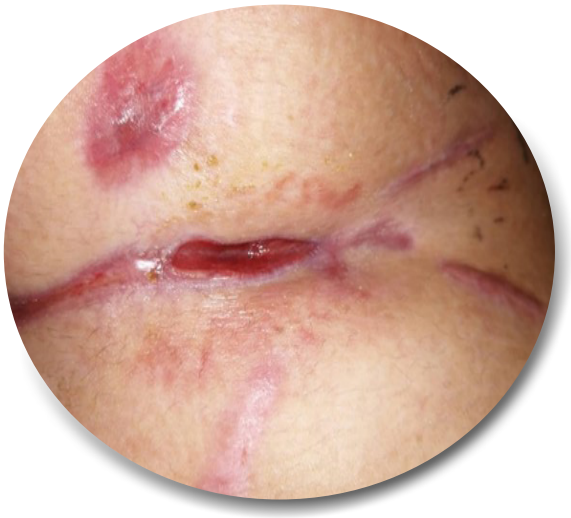
Figure 4. Last placement of the negative pressure system

At week eleven, treatment with wet therapy was performed and the wound presented dimensions of 1.5cm in length, 0.5cm in width and 2cm in depth. It was decided to apply autologous platelet-rich fibrin, so a blood sample was extracted from the patient, centrifuged and fibrin was obtained, which was placed in the wound bed and applied once a week for a month (Figure 5).

Figure 5. Application of platelet-rich fibrin.

From week fifteen onwards the patient was trained to perform daily healing with application of silver sulfadiazine. By week sixteen the wound presented dimensions of 0.5cm long, 2.9cm wide and 0.5cm deep with granulated tissue (Figure 6). Finally, at week twenty the patient was discharged from the wound clinic with the wound 100% epithelialized.

Figure 6. Granular tissue of thoracic window.



## Discussion

The case treated with thoracic window and NPT reduced the time to thoracic window closure to 65 days compared to the study by Munguía Canales *et al.*,[15] in which the negative pressure system was used for 92 days.

The negative pressure varied from -25mmHg to -125mmHg, with a continuous pressure of -75mmHg for most of the treatment time due to the risk of bleeding, while Munguía Canales et al.15 described an initial suction pressure of -75mmHg for 2 days and subsequently increased to -125mmHg.

The combination of the thoracic window procedure with negative pressure systems is optimal in the management of patients with empyema that is not resolved by other techniques. This coincides with the studies of Roe Devia[16] and Mouës *et al*.,[17] who mention that there is a greater reduction in chronic wounds treated with NPT than with the conventional method, which in some hospitals consists of removing the remains of exudate and cleaning the cavity with a compress soaked in physiological saline, and then introducing dry compresses without leaving spaces and placing secondary dressings that are subsequently fixed.[4,16,17]

An important aspect was that outpatient follow-up in the wound clinic allowed out-of-hospital management with satisfactory results, since the nursing staff specialized in wounds eliminated non-viable tissue and carried out correct humidity control to achieve granulated tissue, which led to epithelialization without showing signs of infection.

The time of use of the device was less than that reported in another study[15] on a 21-year-old woman, who presented a post-pneumonic left empyema that did not remit with conventional medical treatment, for which reason an open thoracic window was performed. On the sixth day she was sent home with placement of a closed portable suction system.

## Conclusion

NPT is a technique that reduces healing time in comparison with conventional methods, since it has favorable results during the healing process until total closure is reached through advanced wound management. In addition, it reduces complications such as the presence of bleeding and infectious process, even when there are variable conditions for each patient, according to the size, change of system and wet healing. Likewise, in this case the modality of NPT instillation in the thoracic window was observed, which was safe and with favorable results for the patient. Finally, it is important to highlight the role of the nursing professional as the main care provider through specialized wound clinic practice.

## Ethical aspects

The confidentiality of patient data was always respected, in accordance with Organic Law 3/2018 of December 5 on the protection of personal data and guarantee of rights. The patient's consent was requested for the taking of photographs and their use in research or teaching.

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