

Challenges in the management of a chronic pleural empyema after a right pneumonectomy for NSCLC: efficacy of vacuum-assisted closure therapy

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ABSTRACT

Vacuum-assisted closure (VAC) therapy is an efficacious method for treating chronic and difficult wounds. We present a patient treated by VAC for a chronic pleural empyema after right tracheal sleeve pneumonectomy complicated by bronchopleural fistula (BPF), performed in 2003 for lung cancer. Our aim is to promote VAC therapy use and improve outcomes by addressing some topics such as an adequate case management.

KEYWORDS: empyema, pneumonectomy, vacuum-assisted closure, open window thoracostomy.

1. INTRODUCTION

Postpneumonectomy empyema (PPE) is a rare but potentially fatal complication of pulmonary resections, and its proper management is essential. Appropriate antibiotics combined with surgical treatment are usually the correct approach at the onset of symptoms. Unfortunately, PPE is often associated with bronchopleural fistula (80%) [1], which makes its management a challenge. Optimal strategy includes prevention by minimizing perioperative sepsis, meticulous bronchial closure, and the use of vascularized flaps to reinforce the

bronchial stump. The mortality of PPE, with or without BPF, ranges from 23% to 50% [1].

2. CASE REPORT

A 78-year old man had a history of T3N1M0 right lung squamous cell carcinoma infiltrating the tracheobronchial angle. In 2003 he underwent a right tracheal sleeve pneumonectomy with an intercostal muscle flap to protect the termino-terminal anastomosis between the left main bronchus and the trachea. After discharge, patient was readmitted to the hospital with respiratory failure, cough and fever. Chest x ray and CT scan showed multiple air-fluid levels in the right chest cavity and an empiematic milky fluid was observed after the positioning of a chest drain. Bronchoscopy showed a 3 mm right tracheal fistula. Pleural fluid coltures were negative and the fistula was treated with endoscopic sealant. Therefore, chest drain was removed. After one month, patient was readmitted at the hospital for a recurrent empyema. He rejected a thoracostomy, following which a permanent chest drain was left in the chest cavity. In 2010, after an episode of Methicillin-susceptible *Staphylococcus aureus* (MSSA) sepsis, a right open window thoracostomy (OWT) was performed to improve the local infection control. Over the years, several attempts to close thoracostomy have been made by different surgeons; unfortunately

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Clagett's procedure, latissimus dorsi flap, pectoralis major flap and omentoplasty failed. At the end, the patient has been left with an open chest and the stomia progressively evolved in a pleural-cutaneous fistula with a chest drain (a Malecot catheter) for several years. Chronic purulent secretions were the cause of the recurrent fever, asthenia and frequent hospitalizations with subseptic status. Finally, after a further episode of sepsis, patient came to our hospital. Colture on pleural fluid showed Methicillin-resistant *Staphylococcus aureus* (MRSA). In May 2020 the patient was admitted in our department to perform a thoracostomy and a pleural cavity detersion. At this time, he started vacuum-assisted closure therapy (Medela Invia Liberty NPWT, Medela AG, Switzerland) with an initial negative pressure of 70 mmHg that was gradually calibrated up to 125 mmHg. Sporadic chest pain was managed with paracetamol. Quality of Life (QoL) (Short Form 36-Item Health Survey, Version 2) was extremely more favorable if compared to pre-VAC therapy period. A total of 32 VAC therapy medications were necessary to significantly reduce the pleural space (Fig. 1) and to control local infection. Antibiotic strategy (vancomycin first and then rifampicin plus cotrimoxazol and trimetoprim) was applied accordingly to infectious disease specialist advice. During the period of negative pressure therapy, pleural cavity shranked from 800 ml to 100 ml (Fig. 1). Lastly, a left rectus abdominis musculocutaneous flap was used to completely obliterate the residual right cavity. Right rectus abdominis muscle was not considered in the surgical treatment because of an evidence of a limited vascular support confirmed by angiography of the right deep superior epigastric artery. Six months later, the chest wound was perfectly healed without complications (Fig. 2). The patient started his regular daily activity again without pain and fever.

3. DISCUSSION

VAC therapy has been already adopted for surgical wound treatment in many fields but it is still underused in thoracic surgery. Furthermore, experiences in pleural cavity chronic infection management are almost anecdotic. VAC is referred especially for per secundum wound healing and its use for pleural cavity is hardly considered due to the non-deformable space surrounded by chest cage. Nowadays, several studies have detailed the

changing process in the empyema cavity after VAC therapy [2].

When a postpneumonectomy empyema (acute empyema) is found, there are different key points to address. First of all, the cause of empyema: if the cause is a bronchopleural fistula, every effort should be addressed to close the fistula. Secondly, time is money: the sooner you take action, the sooner you can enjoy your results; detersion of the cavity, with a chest drain or even surgically, allows to manage local infection. Furthermore, nutrition and antibiotics are key points for the success of the therapy [3].

Conversely, chronic empyema is a condition even more difficult to solve: debilitated patients with poli-microbial pabulum wounds and multi-drug resistant infections along with large and non-deformable rigid pleural cavities represent two fundamental factors to be considered all together for the success of the operation.

Failure of previous OWT closure, multidrug resistance infections, lack of viable tissue to obliterate wounds, are all reasons that discourage further attempts of pleural cavity wound closure. Furthermore, patients are unmotivated to undergo a further surgical procedure that usually means a volume reduction of the pleural cavity up to a devastating thoracoplasty [4]. These points make the empyema residual cavity one of the most challenging wounds to treat.

Within this contest, OWT and a subsequent VAC therapy could be considered two important steps for a successful closure. The VAC removes excess fluid, reduces the number of microorganisms and increases the temperature in the wound. Mechanical stress promotes granulation tissue formation and volume shrinking of the pleural cavity, all enhancing the action of antibiotic activity. Most of the published studies have shown a favorable impact of VAC on wound healing [2, 5].

In the case of chronically infected pleural cavity, VAC is even more tolerated by patient, without complications at all, when compared to VAC application in acute pleural empyemas. Indeed, side effects occasionally observed in post-pneumonectomy acute empyema treated by VAC (hypotension, pain, bleeding, arrhythmias) [3] are minimized in chronic empyema, likely due to the stability of the pleural cavity and thus the mediastinum, which are not liable to sudden

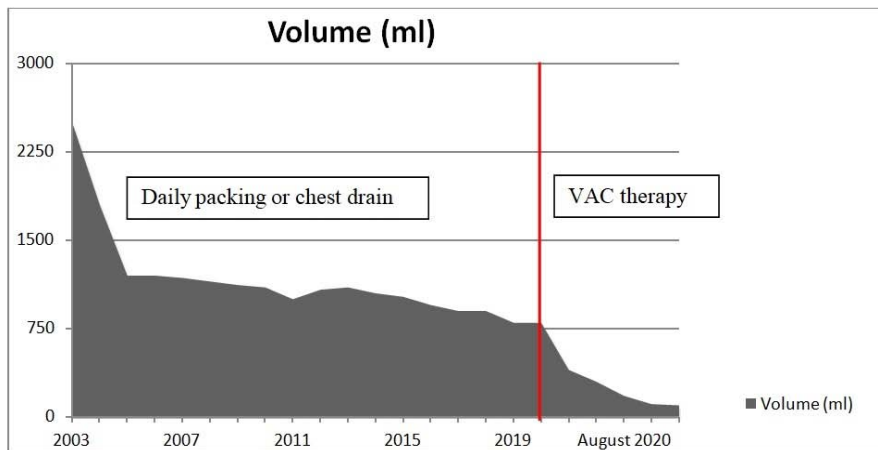


Fig. 1. Shrinkage of pleural cavity before May 2020 (daily packing or simple permanent chest drain) and after May 2020 (VAC therapy).



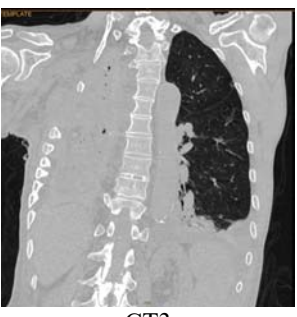



| Before: pleural cavity with chest drain | During: VAC therapy with polyuretan sponge in pleural cavity | After: postoperative, muscle flap and cavity closure (6 months later) |
|--|--|--|
|  <p>CT1</p> |  <p>CT2</p> |  <p>CT3</p> |
|  <p>F1</p> |  <p>F2 + F3</p> |  <p>F4</p> |

Fig. 2. Before, during, and after VAC therapy.

strains even when a high negative pressure is applied.

When performing an OWT to undergo a VAC therapy, the location and size of the stoma, the closeness of vascular structures and the shape of the cavity should be considered; an adequate stoma dimension, its location (not too close to the axillary cavity), a suitable coverage of vascular structures (by anti-adhesive dressings, polyvinyl-acetate sponge) and a meticulous sponge packing help in attaining the best result from negative pressure. In addition, the action to remove the polyurethane filler could cause local vascular trauma, pain and a rupture of the sponge [5]; therefore changing dressing every 3-4 days is strongly recommended.

Residual positive wound swab without any systemic symptoms of infection, after NPWT treatment, should be considered as mere contamination; thus positive swab does not prevent the closure of OWT *per se*. In our experience, when the pleural space appears clean with healthy granulation tissue without gross exudate, the cavity could be closed [3]. Filling with a viable tissue represents a further strategy for a successful procedure. Volume reduction and wound decontamination by VAC therapy in our case report are both prodrome of a successful result.

4. CONCLUSION

Treatment of chronic postpneumectomy pleural empyema remains a challenge, especially if

previous multiple pursuits of treatment have been unsuccessful. VAC therapy is a versatile method to treat different wounds and could be an option to heal an infected chronic thoracic wound, even if the wound dates back to several years.

CONFLICT OF INTEREST STATEMENT

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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