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Localized pyopneumothorax treated with a vacuum-assisted closure system

Riboto piopneumotorakso gydymas vakuumine žaizdų gydymo sistema

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A 52-year-old male was admitted to the Department of General Thoracic Surgery with a right-side localized pyopneumothorax that showed no improvement after conservative treatment. Open-window thoracostomy was created due to the presence of bronchopleural fistula. The capacity of the cavity was 600 ml. On the 11th postoperative day, a spontaneous closure of the bronchopleural fistula occurred. Later, a vacuum-assisted device was used for the residual empyema cavity treatment. It was used for 15 days, sponges were changed every 5 days. The residual cavity reduced in size six times (till 100 ml). The patient was discharged for a daily dressing changing at the outpatient department. After two months the patient was ready for a radical closure of open-window thoracostomy. The postoperative period was uneventful. The case shows that the vacuum-assisted closure therapy can be safely used in open-window thoracostomy after pleural empyema. This method reduces the duration of open-window thoracostomy and accelerates surgical closure.

Key words: pleural empyema, pyopneumothorax, VAC therapy, open window thoracostomy

Penkiasdešimt dvejų metų vyras dėl dešinio riboto piopneumotorakso buvo hospitalizuotas į Krūtinės chirurgijos skyrių, nes konservatyvus gydymas buvo neveiksmingas. Dėl persistuojančios bronchopleurinės jungties padaryta pleurostoma. Vienuoliktą pooperacinę parą bronchopleurinė jungtis savaime išnyko, todėl buvo nuspręsta naudoti vakuuminę žaizdų gydymo sistemą. Aktyvios aspiracijos sistema per sidabru impregnuotą kempinę naudota 15 dienų (kempinės keistos kas penkias dienas). Po šio gydymo kurso pleurostomos tūris sumažėjo nuo 600 ml iki 100 ml. Pacientas išrašytas gydytis ambulatoriškai. Po dviejų mėnesių ertmė buvo sumažėjusi iki 10 ml, visiškai epitelizavosi ir buvo tinkama torakoplastinei operacijai. Gydant pleuros empiemą, kuri komplikavosi piopneumotoraksu, galima sėkmingai naudoti vakuuminę žaizdų gydymo sistemą. Šis gydymo metodas sutrumpina liekamosios pleuros ertmės egzistavimą ir leidžia greičiau atkurti krūtinės sienos vientisumą.

Reikšminiai žodžiai: pleuros empiema, piopneumotoraksas, vakuuminė žaizdų gydymo sistema, pleurostoma

Introduction

Pleural empyema, defined as pus in the pleural space or an effusion with organisms seen on Gram stain, is still a controversial issue [1]. The mortality rate from pleural space infections ranges within 6–24% [2]. Most common bacterias that are found in empyema cases are the ones that are found in pneumonia patients: *Streptococcus Milleri* and *Streptococcus pneumoniae*, *Staphylococcus aureus*, *Enterobacteriaceae*, and anaerobes [1, 3]. Pyopneumothorax is a complication of pleural empyema when there is pus and air collection in the pleural space. It usually develops when a spontaneous bronchopleural fistula (BPF) occurs because of a bronchial pneumonia or lung abscess. Radiographic (chest X-ray, computed tomography (CT), and ultrasound) imaging helps evaluating and managing pleural empyema [4].

The basics of treatment are antibiotic therapy and pleural space drainage, debridement and removing of encapsulated pleural layers [5]. Antibiotics are given empirically and adjusted by growing cultures. For pleural space debridement, video-assisted thoracic surgery (VATS) or open thoracotomy should be considered. A more aggressive approach depending on the general medical condition and presence of the BPF is open-window thoracostomy (OWT) [1, 6].

Since its introduction, vacuum-assisted closure (VAC) therapy has been initially used in the management of a wide range of complex wounds. The VAC benefits include the removal of the accumulating fluid, increased oxygen tension in the wound, increased blood flow, and increased granulation tissue proliferation [7]. For many years, VAC has been used for sternum wound infections. Some recent series reported the possibility to use VAC for complex chest wounds as well as in combination with OWT [5, 8, 9]. Even a minimally invasive VAC procedure with instillation offers an advantage of flushing the pleural space with antiseptic solution and the absence of an OWT [7, 10].

We would like to present the first case in Lithuania of a successfully used VAC system in the treatment of localized pyopneumothorax via OWT.

Clinical case

A 52-years-old male was presented to the Department of General Thoracic Surgery with cough, the right-sided chest pain, and weakness. A history of previous pancreatitis and arterial hypertension was known. The patient had got ill three weeks ago when he started coughing and had a febrile fever. The first week patient didn't seek for any medical help; his status worsened, therefore

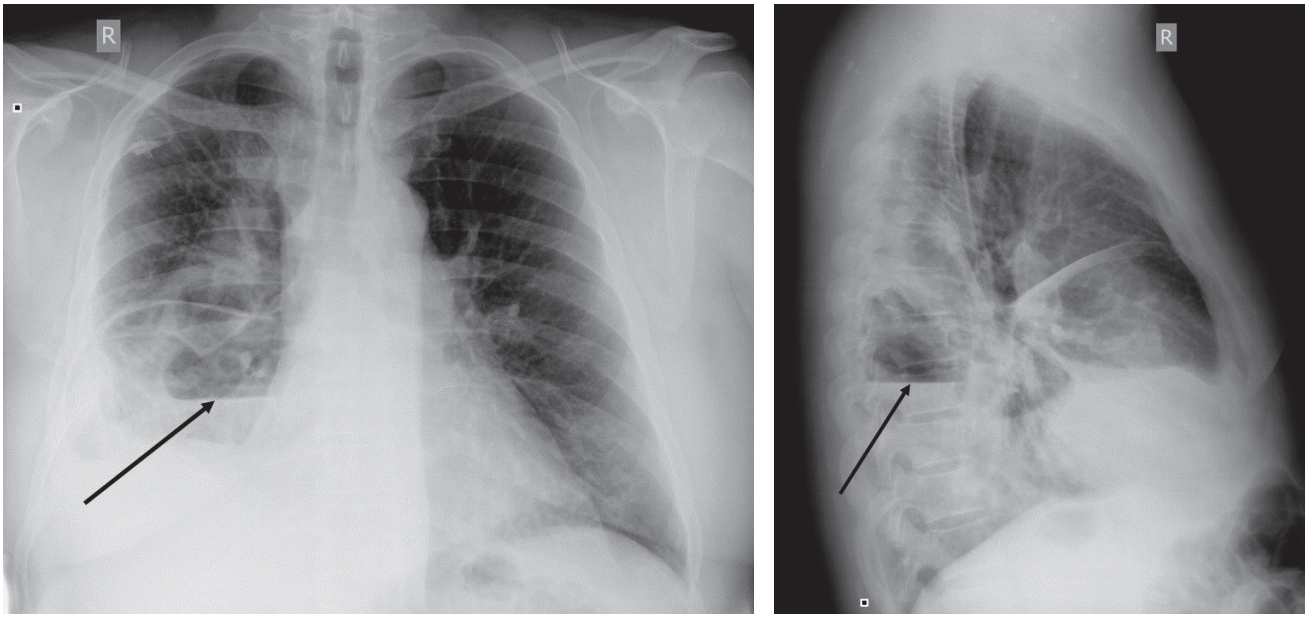

Figure 1. Chest X-ray on admition: the air–fluid level in the posterior aspect of the right chest

he went to his family doctor. According to the clinical signs and chest X-ray, right-sided pneumonia was diagnosed, and peroral antibiotic therapy was started. One week later, as there was neither clinical nor radiological improvement, he was admitted to the Department of Internal Medicine where intravenous antibiotic therapy was initiated. Unfortunately, this treatment also showed no clinical or radiological improvement. The patient's status even worsened, severe dyspnea occurred, and for the next three days he was transferred to the Intensive Care Unit where Imipenem and Cilastatin were given to him. On the chest X-ray, the right pleural thickening and the air-fluid level were observed (Figure 1). Therefore, the patient was presented to a thoracic surgeon. On the ultrasound evaluation, nonhomogeneous collections of fluid with air bubbles were found in the right pleural cavity. The CT scan revealed an encapsulated pyopneumothorax (Figure 2). Blood tests showed signs of infection: leukocytosis (15400/μl), elevated C-reactive protein levels (142.1 mg/l), and anemia (hemoglobin 97.6 g/l).

Right-sided pyopneumothorax was diagnosed, and the patient was moved to the Department of General Thoracic Surgery. Bronchoscopy showed the narrowing of the right lower lobe bronchi because of the pressure from outside; however, no endobronchial lesions were found. Because of the evidence of BPF, the posterior localization of the pyopneumothorax cavity and severe general status of the patient, right mini-thoracotomy with the resection of the eighth right rib was chosen as a method of surgical management. The thickened parietal pleura (one centimeter), 600 ml of pus and debris were found in the pleural cavity. The cavity was cleaned. The lung around the cavity was firmly attached to the chest wall, the surface was covered with a fibrin debris cortex, and the BPF was identified. The decision was made to perform an OWT. In addition, part of the ninth rib was resected, and an OWT was accomplished. The bacterial culture from the pleura showed *Staphylococcus aureus* growth, therefore Cefazoline intravenously was given. The histological examination of the pleura showed a nonspecific purulent pleuritis. After the operation, the OWT dressings were changed daily with betadine and hypertonic solutions. The postoperative period had no complications and showed a clinical and radiological improvement. The bronchopleural fistula closed spontaneously on the 11th postoperative day.

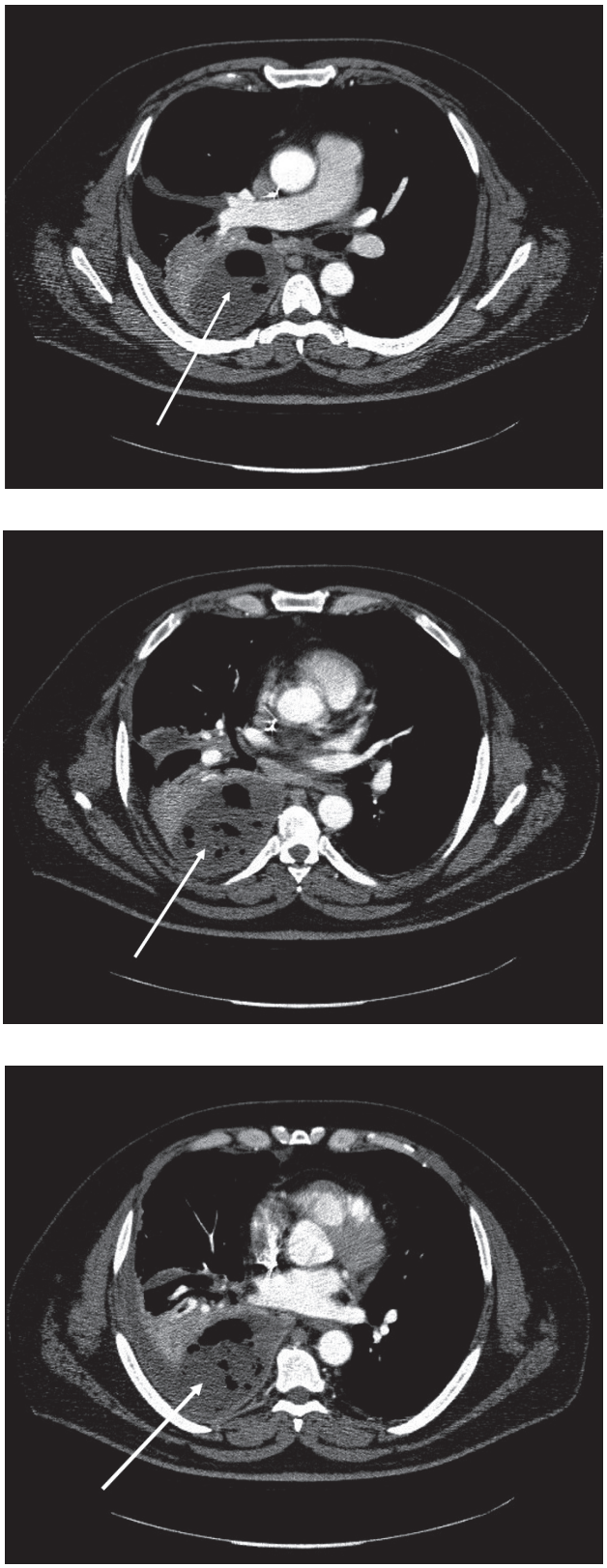

Figure 2. CT scan on admission: encapsulated collection of material with air bubles in the right pleural cavity

Figure 3. OWT before VAC placement

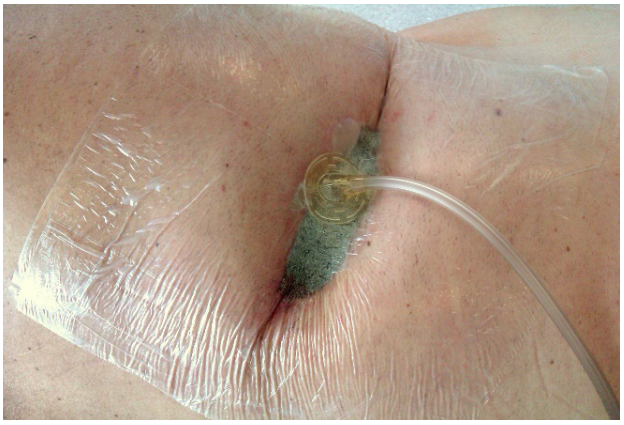

Figure 4. VAC installation

Figure 5. OWT on discharge (after VAC removal)

Figure 6. OWT after a 2-month follow-up

The opened empyema cavity remained 600 ml in size (Figure 3). We decided to apply the VAC system willing to reduce the cavity and to accelerate the cure (Figure 4). The VAC treatment was provided for the next 15 days. Silver sponges were changed every five days only under sedation. The VAC resulted in a quick reducing of the wound and the general clinical improvement. The VAC was removed when the pleural cavity was free from debris, granulations of the cavity surface were seen, and there was a negative culture from the cavity. After the treatment, the OWT volume reduced from 600 ml to 100 ml. The patient was discharged to the outpatient department with a healing OWT (Figure 5). After 2 months the patient's OWT remained only 10 ml in size and was ready to be closed (Figure 6). However, the patient had a stroke, and the surgical closure had to be postponed. After 8 months, only a tiny chest wall defect was observed. The patient was offered to close the OWT, and a thoracoplastic surgery was performed. The patient was discharged on the 8th postoperative day. Figure 7 shows a view 50 days after thoracoplasty.

Figure 7. 50 days after the OWT closure

Discussion

Open-window thoracostomy is sometimes used in treating pleural empyema depending on the general patient's status or when bronchopleural fistulas are present. A fistula has a high risk of reinfection of the cavity if the chest is closed [1]. Although OWT requires quite a long treatment, it is safe, effectively controls the infection, and sometimes is lifesaving. The VAC therapy initially was introduced in order to reduce the time of treatment and to accelerate the healing process. After satisfactory results in treating superficial infected wounds and post-sternotomy infections, VAC was suggested for pleural infections. The main advantages of VAC are obliteration of the dead space among tissue layers and the stimulation of angiogenesis caused by a negative pressure [11, 12], thus resulting in a faster healing and a lower risk of reinfection. The first report of intrapleural VAC therapy was published in 2006, and there is a constantly growing number of reports showing VAC advantages in the treatment of pleural empyema [7, 9, 13–15]. In this case, VAC was considered only after the bronchopleural fistula had closed because the persisting fistula creates an air leak and dehermetizes the space. On the contrary, some authors think that VAC treatment may be used even when bronchopleural fistulas are present [16]. An earlier VAC installment may result in a shorter hospitalization time. We used VAC for 15 days, which is a relatively short period of time resulting in an incomplete healing of the OWT. A decision for secondary closure of the OWT was made two months after seeing the patient in the outpatient department. The reasons were a stable healing and a significant contraction of the OWT. The OWT cavity remained only 10 ml in size and was fully epithelized, so it was ready to be closed. In our experience, the possibility to close the defects after OWT without a VAC system usually is 6 to 12 months after its formation.

Conclusions

The case shows that the VAC system could significantly fasten the healing process and diminish the OWT cavity. Pyopneumothorax can be safely and faster cured by OWT with a VAC system. This method reduces the OWT period and accelerates surgical closure.

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