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Endobronchial valve and vacuum-assisted closure treatment for a complicated air leak problem after cardiac surgery

Kardiyak cerrahi sonrası komplike hava kaçağı sorunu için endobronşiyal valf ve vakum destekli kapama tedavisi

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ABSTRACT

In this article, we report a 57-year-old male patient who developed mediastinitis due to massive air leak after coronary bypass surgery and deteriorated with endobronchial valve application. The patient underwent a long and complicated treatment process with open drainage and vacuum-assisted closure applications and recovered. Although endobronchial valve applications are efficient in the treatment of prolonged air leak, we recommend considering open drainage and vacuum-assisted closure if infectious complications occur.

Keywords: Mediastinal infection; pleural air leak; surgery complications.

ÖZ

Bu yazıda koroner baypas cerrahisi sonrası masif hava kaçağı nedeni ile mediastinit gelişen ve endobronşiyal valf uygulanması ile durumu kötüleşen 57 yaşında bir erkek hasta sunuldu. Hasta açık drenaj ve vakum destekli kapama uygulamaları ile uzun ve komplike bir tedavi süreci geçirdi ve iyileşti. Uzamış hava kaçağı tedavisinde endobroşiyal valf uygulamaları etkin olmakla birlikte enfeksiyöz komplikasyonlar ortaya çıkar ise açık drenajın ve vakum destekli kapamanın dikkate alınmasını önermekteyiz.

Anahtar sözcükler: Mediastinal enfeksiyon; plevral hava kaçağı; cerrahi komplikasyonlar.

The optimal therapy remains debatable when it comes to persistent air leak or bronchopleural fistula occurring in patients with pneumothorax or after lung or mediastinal surgery. Options include treatment with surgery by suturing, stapling, sealant application, endobronchial occlusion, and recently, endobronchial valve (EBV) placement.[1-4] Recent reports on EBV application have demonstrated successful outcomes.[5] In this article, we report our approach for the treatment of a patient who developed mediastinitis due to massive air leak after coronary bypass surgery and deteriorated with endobronchial valve application.

CASE REPORT

Records of a 57-year-old male patient indicate that he was hospitalized at a specialized surgery center for coronary artery bypass grafting and ascending aortic replacement for an aneurysm. After median sternotomy, the left mediastinal pleura were opened during preparation of the left internal mammary artery. A bulla located in the left upper lobe was seen ruptured, and ventilation became impossible due to massive air leak. The patient had a left pneumothorax history and had tight pleural adhesions on the lateral part of the lung owing to a previous chest tube placement. Suturing of the bulla caused even more air leakage. Stapling was impossible due to tight adhesions, and immediate cardiopulmonary bypass was initiated. After coronary arterial bypass and replacement of the ascending aorta, the aortic graft had covered with mediastinal adipose tissue and thymus. Stapling, suturing and placement of fibrin products failed to stop air leakage permanently. In addition to two retrosternal mediastinal drains for the bypass surgery, the cardiovascular surgeons had placed an

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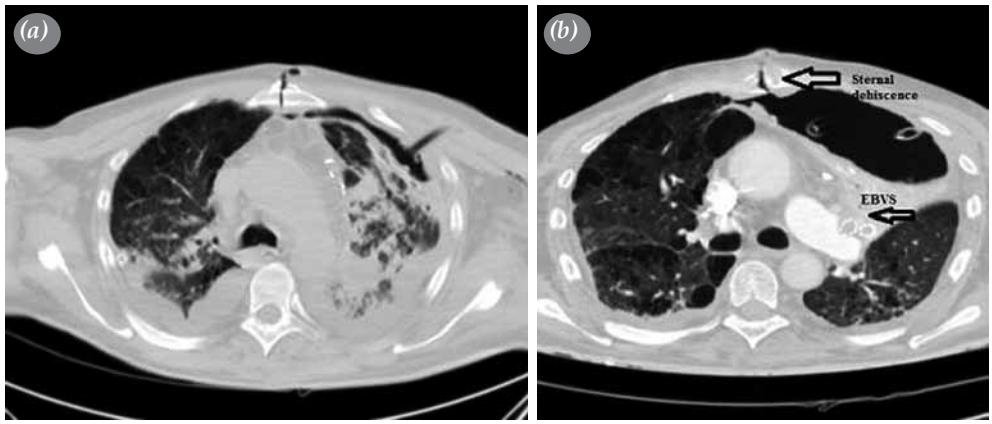

Figure 1. (a) Pulmonary infection, anterior pleural space, and sternal separation. **(b)** Total atelectasis of left upper lobe and a large air space with separated sternum.

apical drain into the left hemithorax. The air leak persisted beyond seven days. The sternotomy incision became infected, and sternal dehiscence occurred. The patient was reoperated on for mediastinal pus drainage and sternal rewiring. However, he remained on a ventilator because of massive air leak, mediastinitis, and pulmonary septic complications (Figure 1a). Following postoperative day 38, three endobronchial valves into the left upper lobe were applied to stop the air leak. Despite a decrease, the air leakage persisted, and the lower part of the sternum separated and remained infected. *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* were cultured from the pus, and another chest drain was placed into the contralateral side. On postoperative day 52, seven days after the placement of EBVs, a chest CT demonstrated total atelectasis of the left upper lobe and a large air space with a separated sternum (Figure 1b).

On postoperative day 54, the patient was admitted to our hospital's intensive care unit. He was still on a mechanical ventilator via tracheostomy. We decided to treat the patient according to classical pleural-mediastinal infection treatment modalities. We performed an open thoracostomy near the sternum on the most dependent part of the anterior space on the left side, debrided the posterior part of the inferior sternum, applied gauze dressings, and washed the cavity with saline two times per day (Figure 2a). After thoracostomy, we removed apical and anterior segment valves to permit the lung to re-expand posteriorly, and one week later, we removed the last valve from the lingula. After daily dressings to the posterior part of the inferior sternum and the anterior paramediastinal space, we weaned the patient from the ventilator and admitted him into the ward. Wound suction to the cavity (VACUlta™ Negative Pressure Wound Therapy System, KCI, USA) was applied, and the patient was discharged from the hospital with a small anterior chest wall defect requiring daily dressing. The open

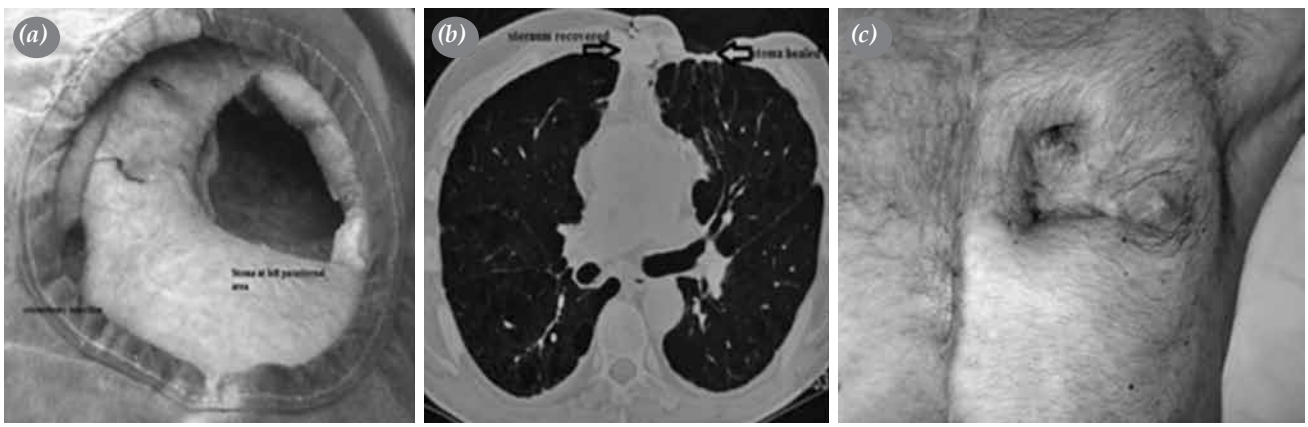

Figure 2. (a) Sternotomy infection and stoma at left parasternal area. **(b, c)** Healed sternum and thoracostoma.

thoracostomy wound closed naturally approximately two weeks after he was discharged (Figure 2b, c), and he returned to work.

DISCUSSION

The mainstays of conservative management for empyema include drainage of the air leak, obliteration of the pleural space, treatment of lung and pleura infections, and optimal nutrition. Persistent air leak without infection and without pleural space may certainly be an option for EBV deployment to the affected lobe. However, pleural space may expand, and empyema may worsen following attempts to stop air leak. After a median sternotomy, intrapleural infection and pressure might increase the possibility of sternal dehiscence.

The literature has reported multiple methods of closure via the bronchoscope, including gel foam, fibrin sealant, methylmethacrylate, injection of absolute ethanol, endobronchial silicone plugs, albumin glutaraldehyde tissue adhesive, decalcified bone and lead plugs.[1-4] However, all of these options should be avoided in the situations mentioned above.

Obviously, the best solution might have been reached through treatment with conventional techniques and equipment, such as performing a pneumolysis and stapling the emphysematous lung with staplers supported by extra materials to prevent air leak. However, this treatment may cause serious bleeding after heparinization for a cardiopulmonary bypass. We believe that a valve treatment could have been used in the early period before the occurrence of mediastinitis, sternal dehiscence, and pulmonary pleural infection. Thus, we recommend considering endobronchial valve therapy before infectious complications occur. Once such complications occur, classical open drainage techniques may be valuable.

Declaration of conflicting interests

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