Successful Tractotomy Technique for a Penetrating Lung Injury in a Patient with One Lung

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We report the case of a patient with penetrating chest trauma (right chest) who had undergone a left pneumonectomy due to pulmonary tuberculosis 24 years ago. We performed an emergent thoracotomy, finding an opening of the penetrating wound in a lower-lobe basal segment of the right lung. A stapled tractotomy was performed along the tract. Bleeding control and air-leakage control was done easily and rapidly. The patient was discharged without any complications on the seventh day of admission. Tractotomy can be a good option for treating penetrating lung injuries in patients with limited lung function who need emergent surgery.

Key words: 1. Lung injury 2. Trauma 3. Foreign body

Case report

A 62-year-old man visited Gyeongsang National University Hospital with a penetrating trauma in his right chest. He had undergone a left pneumonectomy due to a pulmonary tuberculosis infection 24 years ago. He had symptoms of dyspnea and hemoptysis. His respiratory rate was 23 breaths per minute, and his oxygen saturation was 90% in room air. He was conscious, fully responsive to questions, and his initial vital signs were stable. His blood pressure was 150/90 mm Hg, and his heart rate was 100 beats per minute without the use of inotropic drugs. The laboratory findings were as follows: hemoglobin level, 12.2 g/dL; and partial oxygen pressure, 60 mm Hg. Chest computed tomography revealed a 1.7-cm foreign body in the medial basal segment of the right lower lobe and a fracture of the right seventh rib without pneumothorax or hemothorax (Fig. 1). Although his vital signs were stable, dyspnea and hemoptysis were ongoing, and the foreign body could have caused additional lung parenchymal damage and infection. Based on these findings and considerations, we decided to perform emergent surgery. Under general anesthesia and using an intermittent apnea technique, we performed a mini-thoracotomy via the right mid-axillary line of the sixth intercostal space. After adhesiolysis of the whole lung field, we retracted the lung toward the apex and identified the opening site of the penetration tract at the right lower lobe of the medial basal segment. We also confirmed that there was no damage to the major vessels or hilar structure airways. With Duval clamps placed parallel to the wound tract, a linear stapler
was placed through the tract and was fired to separate the lung parenchyma and expose the bleeding focus and injured airway (Fig. 2). Hemostasis and airway control were achieved with multiple 3-0 polypropylene interrupted-suture ligation. A 1.3-cm metal fragment was extracted at the end of the distal wound tract. A 28-Fr right-angled chest tube was indwelled in the right pleural cavity, and the wound was closed in a standard manner. The total surgery time was 90 minutes; no transfusion was made during surgery. The endotracheal tube was removed immediately after surgery, and the patient was transferred to the general ward after recovering from general anesthesia. The patient had no significant complications after surgery. The chest tube was removed on the third day of admission, and he was discharged on the seventh day of admission without any notable events or additional transfusions.

**Discussion**

Surgical treatment for penetrating chest trauma is very challenging and has high mortality and morbidity rates. In emergent situations, the successful treatment of traumatic lung injuries requires rapid intraoperative evaluation, precise control of the injury via rapid bleeding control, a short operative time, and the quick correction of coagulopathy and metabolic acidosis [1]. For this reason, surgical removal of impacted foreign bodies from the lung after a penetrating trauma is indicated when significant hemothorax, persistent pneumothorax, major vessel injury, sepsis, or signs of lead poisoning are identified, or when the patient complains of symptoms [2]. Appropriate surgical techniques can be classified as nonanatomical lung resections (e.g. wedge resection, suture pneumorrhaphy, or stapled or clamp pulmonary tractotomy) or anatomical lung resections (e.g. lobectomy or pneumonectomy) [3]. The classical surgical technique for the management of penetrating lung injuries is anatomical resection, either by thoracotomy or video-assisted thoracoscopy. Numerous studies have reported on the advantages of nonanatomical resection over anatomical resection in patients with penetrating chest trauma who need emergent surgery. These advantages include less time with mechanical ventilation, shorter intensive care unit and hospital stays, and lower mortality and morbidity rates, and are related to shorter operative times and
Lung Injury and Tractotomy

Fig. 3. (A) A stapling device was placed at the penetrated wound. (B) The stapling device was fired, creating a tractotomy. (C) The tractotomy exposed bleeding vessels and selective ligation was performed. From Asensio et al. J Am Coll Surg;185:486-7, with permission from Elsevier [6].

less blood loss, as well as the preservation of postoperative respiratory function [4].

Among the nonanatomical resection techniques, direct pneumorrhaphy may cause an intrapulmonary hematoma or air embolism, and wedge resection may lead to a postoperative reduction in respiratory volume. Pulmonary tractotomy was described by Walls et al. [5] in 1994. In their study, the authors treated patients with penetrating injuries that did not involve the central hilar major vessels or airway [5]. The overlying lung parenchyma of a through-and-through wound tract was opened by two aortic clamps placed along the opening and exit orifice of the wound tract, and the roof of the wound tract was divided between 2 clamps. This procedure exposed the bleeding and air leakage site and provided a direct surgical view of the lesions, which were then rapidly and easily suture-ligated for hemostasis and airway control. This procedure also preserved the postoperative lung volume by preventing unnecessary lung resection. Asensio et al. [6] modified this technique, using a stapler to perform a tractotomy, with more effective and time-saving results (Fig. 3). Thus, many authors have claimed that a pulmonary tractotomy technique can be initially attempted to treat penetrating chest trauma.

In our case, the patient had a high risk of postoperative lung problems given his comorbidities. Lung resection after contralateral pneumonectomy is challenging because of the patient’s inadequate respiratory reserve. Wood [7] found that in contralateral pneumonectomy patients, higher mortality and morbidity rates were associated with greater resected lung volume because of the cardiac overload caused by the change in pulmonary circulation and the reduction of pulmonary function. Therefore, our major concerns for the patient were (1) to spare as much lung volume as possible; (2) to obtain a good operatio

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Conflict of interest

No potential conflicts of interest relevant to this article are reported.

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