Bronchopleural fistula after lower lobectomy of the right lung following thoracic endovascular aortic repair

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Abstract

A 77-year old male patient was admitted for the treatment of a thoracic aortic aneurysm (TAA) and primary lung cancer. A saccular aneurysm, 4.8 cm in diameter, located in the proximal segment of the descending thoracic aorta and a pulmonary tumour, 3 cm in diameter, located at the right lower lobe, with lymph node swelling, were detected simultaneously. First, a thoracic endovascular aortic repair (TEVAR) was performed for TAA, and then 45 days later, a lobectomy and radical lymph node dissection by open thoracotomy were performed safely for primary lung cancer. The postoperative course was complicated by a bronchopleural fistula (BPF). Massive necrotic changes to the bronchial stump and the intercostal muscle flap were observed during an open window thoracotomy. Both the chronic use of corticosteroids and TEVAR may have been among the predisposing factors for the occurrence of the fistula. The patient died as a result of respiratory failure 68 days after the lobectomy. This is a first case report of a BPF after a staged operation of TEVAR and major lung surgery. We reviewed and discussed the surgical strategy and timing for both the primary lung cancer and the thoracic aortic aneurysm.

Keywords: Lung cancer surgery • Bronchial arteries • Endovascular procedures

INTRODUCTION

Treating a thoracic aortic aneurysm (TAA) and primary lung cancer that are simultaneously diagnosed is a challenge. Reports are rare concerning the outcomes of lobectomy for primary lung cancer nearly 1 month after thoracic endovascular aortic repair (TEVAR) for a TAA. In this paper, we report the case in which a patient underwent radical surgery for primary lung cancer following a TEVAR for a TAA.

CASE PRESENTATION

A 77-year old male patient was admitted to our department for the treatment of primary lung cancer and a TAA (Fig. 1a). His medical history included the implantation of a pacemaker for sick sinus syndrome, a radical operation for bladder cancer, rheumatoid arthritis and interstitial pneumonia that had been treated with oral prednisolone at a dosage of 7.5 mg/day for several years. He was 77 years of age when both a TAA and primary lung cancer in the right lower lobe were simultaneously detected by chest CT in an outpatient clinic. The TAA was of a saccular type in the proximal segment of the descending thoracic aorta and 4.8 cm in diameter, with a mural thrombus (Fig. 1b). The primary lung cancer was located in the right lower lobe, S¹⁰, at a size of 3.5 cm in diameter and sputum cytology strongly suggested a squamous cell carcinoma. It was thought to be cT2aN1M0, stage IIB, considering the hilar lymph node

swelling from CT findings. A staged operation was scheduled. Because of the risk of rupturing the aneurysm, the saccular TAA was treated firstly by TEVAR (TG3715, W. L. Gore & Associates, Inc., CA, USA). A TAG (W. L. Gore & Associates, Inc., CA, USA) device, 15 cm, was inserted from the zone 2 to the Th 6 level (Fig. 1c). Forty-five days later, the right lower lobectomy and lymph node dissection were performed as a second step. At the time of the right lower lobectomy, the bronchial stump was closed by the stapler (TL30, Ethicon Endo-Surgery, Inc., NM, USA) and covered with a pedicled intercostal muscle flap sutured to the bronchial stump itself, which was the routine procedure with the right lower lobectomy in our institute. After two major operations, complications occurred. BPF was suspected due to massive persistent air leakage from the chest drain and the right lung collapse. An open window thoracostomy was performed twenty-three days after the lobectomy. Intraoperatively, the pedicled intercostal muscle was found to be completely ischaemic, and the bronchial stump had become massively necrotic, which suggested that bronchial intercostal arteries were occluded (Fig. 2). A complete pneumonectomy after an open window thoracostomy was not indicated because of the patient's poor nutritional condition and consideration of respiratory function tests before the lobectomy [forced expiratory volume in 1 s: 1.92 l (63.32% of FVC), vital capacity: 3.04 l (90.5% of the predicted value), diffusing capacity for carbon monoxide: 87.7%]. After thoracostomy, aspiration pneumonia occurred and *Pseudomonas aeruginosa* and *Enterococcus faecalis* were identified. Despite all of our efforts, he died of respiratory failure 68

Figure 1: (a) Preoperative X-ray of primary lung cancer in the right lower lung field, with a stent graft already inserted in the descending thoracic aorta. (b) Chest CT showed a saccular aneurysm, 4.8 cm in diameter, with mural thrombus in the proximal side of the descending aorta. (c) Chest CT showed no endoleak into the saccular aneurysm after the TEVAR procedure.

Figure 2: Massive necrosis of the bronchial stump in the right lower bronchus.

days after the lobectomy. The autopsy revealed inflammatory and organized changes in the bilateral lungs with no evidence of residual tumour microscopically. An aortic stent-graft had also penetrated into the wall of the oesophagus, forming an ulcer through the aortic wall, although this was not a cause of death.

DISCUSSION

The simultaneous treatment of a TAA and primary lung cancer is relatively rare and has been a challenging problem. Before the development of TEVAR, several one-stage operations were reported [1]. Currently, the strategy of a staged operation with TEVAR is preferred because it may reduce postoperative morbidity and mortality, and no other reports had any BPF problem [2, 3]. All of the risks and the patient's condition (TAA size, shape, lung cancer stage, pulmonary function tests) must be considered and treated on a case-by-case basis. TEVAR is considered to be superior to open surgery for the repair of aortic aneurysm

because it requires a shorter hospitalization period, has fewer complications and has the same survival rate for over 1 year to 48 months [4, 5]. Although the long-term outcome of TEVAR remains unknown, in cases with a TAA and other diseases requiring surgical treatment, TEVAR is a suitable option, especially for high-risk patients. In the case presented here, the lobectomy prior to TEVAR was discussed, but the risk of rupture of the TAA was considered to be higher from its shape and size and we decided to perform the TEVAR procedure first.

A bronchopleural fistula (BPF) is one of the most severe and challenging complications of major lung surgery performed for primary lung cancer. The incidence of a BPF after a lobectomy or bilobectomy has gradually decreased recently and has been reported to be ~1.2–3.1%; however, the mortality rate has been high at 27.2–54%, with the BPF being one of the most critical complications [6, 7]. The risk factors of BPF (e.g. squamous cell carcinoma, preoperative chemotherapy, lower lobectomy or middle and lower lobectomy) have been discussed in various papers. This case had several major risk factors and was evaluated to be at high risk for a postoperative BPF.

Considering the aetiology of BPF in this case, not only the chronic use of corticosteroids but also a prior TEVAR procedure that caused the obstruction of the right main bronchial arterial flow might be related to the BPF. The necrotic change of the bronchial stump and the intercostal muscle flap suggested the loss of arterial flow from the aorta. Moreover, the impairment of wound healing, which is one of the side effects of steroid intake, might imply both the lack of adhesion and the occurrence of a massive BPF (Fig. 2). A more critical discussion about the estimation and preservation of the bronchial artery and the optimal interval between the two procedures was held.

During the TEVAR procedure, the bronchial artery is one of the aortic branches that can suffer an endoleak type II, which is conservatively treated in most cases. However, the complete occlusion of the bronchial artery may cause insufficient bronchopulmonary circulation [8]. Bronchial arterial flow is indispensable for peripheral pulmonary circulation, which has been proved by perfusion scintigraphy following a lung transplant [9].

The autopsy revealed an aorto-oesophageal fistula incidentally, which was an unusual and possibly catastrophic complication

after TEVAR, and its incidence is reported up to 1.9% within 1–16 months after TEVAR [10]. The prognosis of this complication was very poor due to fatal haematomesis and mediastinitis.

In summary, when both a TAA and primary lung cancer are diagnosed at the same time, a TEVAR may be the preferred treatment option for the TAA; however, the bronchial artery supply might be impaired by the surgery, and special attention should be given to adequate bronchial stump healing following major lung surgery. The optimal interval between the two procedures should allow the development of a collateral bronchial arterial flow, and the timing of the two procedures should be scheduled carefully. Other reports on similar cases are needed to discuss the surgical strategy.

Conflict of interest: none declared.

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