A Successful Case of Robotic Bronchoplastic Lobectomy for Lung Cancer

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We performed robotic bronchoplastic upper lobectomy for squamous cell carcinoma of the right hilum of the lung. The patient was a 56-year-old male and surgery was performed using 3 robotic arms and 1 assistance. Deeply wide wedge resection and interrupted suture were applied to the bronchus of the upper lobe. The pathological stage was pT1bN1M0, IIA. Chest drain tube was removed on postoperative day 2 and no postoperative respiratory complication occurred. The key for success of this procedure is accustoming to robotic manipulation, especially suturing technique because of the absence of a tactile sense.

Keywords: bronchoplastic lobectomy, lung cancer, robotic surgery

Introduction

With the spread of video-assisted thoracic surgery (VATS) for lung cancer, superior low-invasiveness and outcomes comparable to those of thoracotomy have been reported. However, the complex operation of VATS is problematic, and the difficulty of bronchoplasty has been pointed out. Robotic surgery recently developed mainly in the urology field has been attracting attention due to its favorable operability, and it is also applied in the thoracic surgery field. However, reports on robotic bronchoplasty have been limited because of its complexity. We performed robotic bronchoplastic upper lobectomy (robotic bronchoplasty) for squamous cell carcinoma of the right hilum of the lung.

Case Report

A chest abnormal shadow was detected in a 56-year-old male on a medical checkup. On chest computed tomography (CT) (Fig. 1), a tumor was detected in the hilum of the lung, and the marked accumulation (standard uptake value: SUV 5.4) of 18-fluorodeoxyglucose (FDG) was noted on positron emission tomography (PET). A tumor narrowing the bronchial orifice of the right upper lobe was noted on bronchoscopy (Fig. 2a), and squamous cell carcinoma was diagnosed by biopsy. The patient had various past medical histories of nephrosclerosis-associated renal dysfunction (creatinine: 2.26), obesity (body mass index (BMI): 30.3 kg/m²), obstructive respiratory dysfunction (FEV1.0%: 56.7%, FEV1.0: 1,980 ml), chronic hepatitis, cholelithiasis, hypertension, hyperuricemia, and hyperlipidemia. Informed consent (IC) for robotic surgery using da Vinci S (Intuitive Surgical, Sunnyvale, California, USA), was obtained from the patient and his family. Surgery was performed under general anesthesia with differential lung ventilation in a left lateral position. A patient cart was rolled in from the cranial side and 3 robotic arms were used. A 5-cm access wound (for right arm) was made in the 5th intercostal space, the anterior axillary line, a 12-mm port (for 30-degree 3D-hi-vision camera) was prepared in...
the 7th intercostal space, the middle axillary line, an 8-mm port (for left arm) on the posterior axillary line, and a 12-mm port (for assistance) below the angle of the scapula. The operator remote-controlled the robot arms from the surgeon console. After the dissection of severe pleural adhesion, we divided hilar vascular vessels (pulmonary vein, pulmonary artery in order) with auto-suturing device and mediastinal lymph node dissection, deeply wide wedge resection was applied to the bronchus of the upper lobe. The negativity of the bronchial stump was confirmed by rapid pathological examination, and 16 stitches of interrupted suture with 4-0PDSII (Ethicon, Somerville, New Jersey, USA) were applied (Fig. 2b and 2c). Although robotic stitches were very easy, cutting of the thread occurred several times while ligation. Finally, the bronchial stump was covered with pediculate thymic fat. The tumor size
was 26 × 17 mm, and the histologic type was squamous cell carcinoma, pT1bN1M0, stage IIA. The console operation time was 403 minutes, and blood loss was 170g. The chest drain tube was removed on day 2 after surgery and no respiratory complication occurred. On bronchoscopy performed at 1 week after surgery (Fig. 2d), no stenosis was noted in the anastomotic site, and healing was favorable. As of 14 months after surgery, no recurrence had occurred.

Discussion

Although VATS lobectomy for stage I lung cancer originating in the peripheral lung field has widely spread,1) its application for lung cancer of the hilum is still controversial with regard to safety and curability. Particularly, VATS was previously contraindicated for cases requiring bronchoplasty, and thoracotomy was preferred. With the recent advancement in VATS technology and devices, bronchoplasty employing VATS has been occasionally reported2,3) but its operability is limited. On the other hand, robotic surgery has come to be applied for lobectomy for lung cancer because of the favorable operability of the 3D-Hi vision camera and articulated robot forceps.4-6) Robotic surgery is advantageous in simplifying complex procedures, and its application for bronchoplasty is expected. Ishikawa et al.7) reported that robotic bronchoplasty was superior in accuracy and safety to VATS when it was applied in cadavers. In actual clinical cases, Schmid et al.8) reported hybrid surgery, that is, right upper lobectomy employing VATS was performed for a typical carcinoid of the right hilum and bronchoplasty employing robotic surgery for suture, which is difficult in VATS, for the first time. They could complete surgery within a relatively short time (50 minutes) by concomitantly applying continuous suture for bronchial anastomosis. In the presented case, we employed robotic bronchoplasty for squamous cell carcinoma of the right hilum and suture by single ligations with a monofilament, 4-0PDS II, for bronchial anastomosis, but the anastomosis required a lot of time because the thread was loosened or cut while ligating. To overcome the absence of a tactile sense, a most unfavorable disadvantage of robotic surgery, modification may be necessary, such as the selection of braded or thick thread and concomitant application of continuous suturing. The application of robotic surgery in the thoracic surgery field is still under development, and direct comparison with VATS is necessary in the future. Although this is still only the second clinical case of robotic bronchoplasty reported in a journal, the advantages of robotic surgery can be maximized in this procedure, and further development is expected. We conclude that the operability of robotic bronchoplasty surpasses that of VATS, and it is attractive and its development as a new surgical approach is expected. However, modification and skills are necessary for robotic ligation procedures because of the absence of a tactile sense.

Disclosure Statement

We do not have any financial support or relationships that may pose conflict of interest.

References