How-to-do-it

Video-assisted limited anterior thoracotomy approach for lingular segmentectomy and left anterior descending coronary artery bypass

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Abstract

Minimally invasive cardiothoracic combined surgery was performed successfully in an octogenarian with left anterior descending coronary artery disease and concurrent adenocarcinoma in the lingular segment of emphysematous lung. Through a limited anterior 4th intercostal thoracotomy, left anterior descending coronary artery bypass grafting without cardiopulmonary bypass was carried out using the left internal thoracic artery (LITA) and the interposed vein graft, and subsequently lingular segmentectomy was accomplished. Videothoracoscopy via a single port placed at the 5th intercostal space below the left nipple was useful for LITA mobilization, lymph nodes sampling and endo-cutter guidance.

Keywords: Minimally invasive coronary artery bypass; Video-assisted thoracic surgery segmentectomy; Thoracoscopy

A limited thoracotomy with videothoracoscopic assistance is a practical approach for minimally invasive cardiothoracic surgery. This communication describes the use of minimally invasive coronary artery bypass (MICAB) and lingular segmentectomy via a limited left anterior thoracotomy under thoracoscopic assistance in an octogenarian with impaired pulmonary function, who suffered from angina pectoris due to left anterior descending coronary artery (LAD) disease and concurrent lung cancer in the left upper lobe.

1. Patient, surgery and outcome

The patient, an 81-year-old man, presented with bronchoscopically confirmed adenocarcinoma in the lingular segment. Preoperative chest X-ray and computed tomography revealed a tumor (2.5 × 2.0 × 2.0 cm) in the lingular segment with no mediastinal lymphadenopathies and diffuse emphysema of both lungs, and spirometry demonstrated impaired lung function (forced expiratory volume in 1 s 1.45 l, and vital capacity 3.47 l; 43 and 118% of the predicted values, respectively). The patient had also suffered effort angina for 2 years, and coronary angiography demonstrated a tight, 2-cm long stenosis at the proximal portion of the LAD. Therefore, a minimally invasive approach using video-assisted limited anterior thoracotomy was selected for treating both the coronary artery disease and lung cancer.

General anesthesia was established through a double lumen endotracheal tube and the patient was placed in the right hemilateral position. A 7-cm skin incision was made between the left nipple and the sternum, and an anterior thoracotomy was placed at the 4th intercostal space (Fig. 1). A 5-mm, 30-degree rigid thoracoscope was introduced into the chest cavity via the port, placed at the 5th intercostal space beneath the left nipple (Fig. 1). The left lung was collapsed and the entire chest cavity was inspected thoracoscopically. Botallo’s lymph nodes less than 1 cm in diameter were found and sampled, but frozen sections revealed no metastasis. The left internal thoracic artery (LITA) was harvested as far as the upper margin of the 1st rib through the thoracotomy using thoracoscopic assistance. As the LITA branched off into two small arteries at the level of the 4th rib, a short piece of the saphenous vein was used for interposition. Heparin was systemically infused, maintaining an activated clotting time of around 250 s, and the interposed vein graft was anastomosed to the turniquetted LAD using an epicardial stabilizer (Fig. 2a, b). Thereafter, heparin was neutralized and lingular segmentectomy was carried out: the lingular branches of the pulmonary vein, artery and bronchus were exposed and divided in this order. The vessels were double-ligated with silk sutures using a knot-pusher, and the bronchus was...
cut with an endoscopic linear cutter (ENDOPATH®; Ethicon Endo-Surgery, Cincinnati, OH). The lingular segment tissue was resected using the ENDOPATH® and removed via the limited thoracotomy (Fig. 2b). About 3–5 ml of 0.5% bupivacaine was thoracoscopically injected into each of the 3, 4 and 5th intercostal spaces for intercostal blocking, and a chest tube was left through the port-incision.

The operation time and blood loss volume was 4 h 40 min and 280 ml. Hemorrhage was negligible during lingular segmentectomy and no blood transfusion was performed. The patient was extubated on the operating table and the postoperative course was uneventful except for a temporary episode of atrial fibrillation. Postoperative pain was tolerable without analgesia, the chest tube was removed on the 3rd postoperative day, and the patient was discharged from hospital 6 days after surgery. Angiography via the left brachial artery confirmed patency of the LITA-saphenous vein graft on the 2nd postoperative day. The resected lung tumor was histologically proved to be well-differentiated adenocarcinoma and all lymph nodes in the specimen were microscopically cancer-negative. Thus, the lung tumor in the present patient was finally classified as T1N0M0. When the patient was last seen 3 months after surgery, he had no angina or dyspnea on effort.

2. Comments

Cardiopulmonary bypass was reported to have significant adverse impacts upon human cellular immunity [1], hence the patients with coronary artery disease and concurrent neoplasm can be candidates undergoing recently developed off-pump coronary artery bypass surgery. Although unusual, it has been reported that lobectomy or segmentectomy for

Fig. 1. Schematic drawing of skin incisions for a limited anterior 4th intercostal thoracotomy (arrow) and a thoracoscopy port at the 5th intercostal space (arrowhead).

Fig. 2. Photographs showing a bypass graft (arrowheads) to the LAD and a cut end of the lingular bronchus (arrows) seen through a limited thoracotomy at the left anterior 4th intercostal space. H: heart; and L: lung.
surgical treatment of lung cancer and off-pump coronary artery bypass surgery can be achieved concomitantly through a median sternotomy, a standard thoracotomy or separate small thoracotomies [2–4].

To our knowledge, however, minimally invasive cardiothoracic combined surgery like that used in the present case, video-assisted thoracic surgery (VATS) segmentectomy and MICAB completed through the same limited thoracotomy and a single thoracoscopy port, has not been documented. A mini-thoracotomy approach has been used in both lung resection by VATS and MICAB to the LAD and/or a diagonal branch. Compared with conventional operations, both innovative, less invasive procedures allow shorter convalescence and hospitalization, lower morbidity and mortality, and lower overall cost [5,6]. Currently, we have been using MICAB routinely for a single coronary artery bypass to the LAD with a LITA graft. As far as VATS lobectomy/segmentectomy is concerned, however, the patients have been strictly selected and they had no mediastinal lymphadenopathies in the preoperative chest computed tomography and had high risks such as the age over 75 years old, impaired lung function or cardiac problem.

Just beneath a limited anterior 4th intercostal thoracotomy used in the standard MICAB approach, the upper half of the left pulmonary hilum can be seen directly and direct management of the left upper lobe vessels and bronchus is achievable. Furthermore, thoracoscopy through a port at the 5th intercostal space underneath the left nipple is useful for LITA harvest, lymph-node sampling and endo-cutter guidance.

In conclusion, although applicable to only a limited number of patients with left upper lobe lesions, VATS segmentectomy or lobectomy can be performed concomitantly with MICAB using a single limited left anterior 4th intercostal thoracotomy and videothoracoscopic assistance via a single port.

References