Single Incision Thoracoscopic Left Lower Lobe Superior Segmentectomy for Non-Small Cell Lung Cancer

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Lobectomy with mediastinal node dissection has been standard treatment for non-small cell lung cancer (NSCLC). Nowadays, video-assisted thoracoscopic surgery (VATS) is gaining acceptance as an alternative treatment option, given the quality-of-life benefits that it confers. For the VATS procedure, most surgeons create two or three ports with a utility incision of 3 to 5 cm. However, with acquired skill and instrumentation advances, single-incision thoracoscopic surgery has emerged over time. Here, we report the case of an 86-year-old female with NSCLC treated by single-incision segmentectomy.


CASE REPORT

An 86-year-old female was referred to Seoul St. Mary’s Hospital because of abnormal chest X-ray findings. The chief complaints were intermittent cough and mild fever ongoing for one month. Computed tomography (CT) revealed a mass (3.3×2.2 cm) in the lingula of the left upper lobe (LUL) and a second lesion (2.2×1.6 cm) in the superior segment of the left lower lobe (LLL), which were most likely malignant (Fig. 1A, B). Preoperative assessments included magnetic resonance imaging of the brain, bone scan, whole-body positron emission tomography-CT, echocardiography, and bronchoscopy. Clinically, an abscess of LUL and a cancer of LLL (stage cT1bN0M0) were suspected. Preoperative forced expiratory volume in one second (FEV1) was 1.37 L. Echocardiography revealed normal ejection fraction (60%), but aki-nesia on the basal posterior wall and a ventricular premature complex were observed in the electrocardiography. For the complete resection, lingular segmentectomy and LLL lobectomy should be carried out. Postoperative FEV1 was estimated to be 0.9 L. Due to advanced age and poor respiratory function, the surgical plan was wedge resection for the LUL lesion first. If the lesion was not malignant on the frozen report, the next step was the superior segmentectomy of LLL.

Under general anesthesia, a double-lumen endotracheal tube was placed, and the patient was transitioned to the right lateral decubitus position. Once selective lung ventilation was achieved, a 4-cm incision was made in the fifth intercostal space at the anterior axillary line with a wound protector (Applied Medical, Rancho Santa Margarita, CA, USA). The
two distinct masses were digitally palpable, with a visible retraction of the lower lobe visceral pleura. The cavitary lesion in LUL was sizable. Simple wedge resection was difficult for complete resection. First, the anterior portion of the fissure was dissected and divided, exposing the interlobar artery (Fig. 2A). The lingular segmental artery was then identified and divided, followed by the elevation and resection of the upper lobe mass. Then, complete resection was achieved, and the distance between the mass and the resection margin was 0.6 cm. After there was no evidence of malignancy on the frozen section report, the superior segmental artery (encircled by a drain catheter) was identified and divided using an endostapler (TriStapler; Covidien, Norwalk, CT, USA) (Fig. 2B). The inferior pulmonary ligament was divided to reveal the inferior pulmonary vein. Eventually, the superior segmental vein was divided using a Hem-o-lok (Teleflex Medical Inc., Research Triangle Park, NC, USA). After identifying the superior segmental bronchus, the peribronchial tissue and lymph nodes were dissected. Then, the bronchus was clamped, and both lungs were ventilated (Fig. 3A), enabling the visual-
Single Incision Thoracoscopic Segmentectomy

Fig. 4. (A) Subcarinal and (B) para-aortic lymph nodes were dissected for complete resection.

Fig. 5. (A) The chest tube was placed via the posterior portion of the utility incision, and (B) the skin incision was closed with the subcuticular running suture method.

ization of the segmental plane and stapler division (Fig. 3B). Mediastinal lymph node dissection (para-aortic, subcarinal, inferior pulmonary ligament, and paraesophageal lymph nodes) was performed (Fig. 4A, B). A chest tube (24 Fr.) was placed in the pleural cavity through the utility incision, and the wound was closed (Fig. 5A, B). The total operative time was 135 minutes. Histopathology confirmed an abscess of LUL and an adenocarcinoma (1.6×1.4 cm) of LLL with the invasion of the visceral pleura (stage T2aN0M0), and a distance of 3 cm was obtained between the tumor and the divided segmental plane. The patient was discharged on postoperative day 7 without complications.

DISCUSSION

Since its introduction in the 1990s, video-assisted thoracoscopic surgery (VATS) has been an attractive treatment modality for thoracic surgery, resulting in shorter recovery periods and less postoperative pain than open procedures [1]. Although, generally, three or four incisions are used for VATS lobectomy or the segmentectomy of lung cancers, a report by Rocco et al. [2] on uniportal VATS wedge resection, citing the potential to reduce postoperative pain and paresthesia, has caught the interest of thoracic surgeons. Since 2010, Gonzalez-Rivas et al. [3] have adopted this technique for lung cancer surgery, confirming its feasibility in a recent publication.

Recently, many centers have adopted the abovementioned technique [4]. Furthermore, segmentectomy has also been performed by single incision [5]. Although lobectomy is the standard surgical management for early lung cancer, lobectomy is not suitable for all patients. Most of these patients are elderly and have poor cardiopulmonary reserve. Segmentectomy is a reasonable alternative procedure. In a comparison of segmentectomy with lobectomy for non-small cell lung cancer <2 cm, Okada et al. [6] found that the 5-year survival rates did not differ by procedure. In particular, in the older patients, segmentectomy leads to less complications and
low comparable oncologic impact than lobectomy [7].

We extended our experience with VATS for lung cancer to include a single-incision approach using a 4-cm utility incision of the 5th intercostal space (at the anterior axillary line). A wound protector is employed to protect the camera lens from oozing by the intercostal muscle. The required instrumentation does not otherwise differ from that of conventional VATS (endograsper, 10-mm camera with 30° angle, right-angle clamp, and ultrasonic device). The operative procedure differs according to the affected lobe. During dissection, we use a harmonic scalpel (Ethicon Endo-Surgery Inc., Cincinnati, OH, USA).

A harmonic scalpel is very useful and suitable for the dissection and coagulation of microvessels because of its blunt tip and scissors-like action. We preferred a long right-angle clamp with a blunt tip during the tunneling and encircling of the vessels and the bronchus.

Single-incision VATS does have some limitations. Clearly, when the multiple views of conventional VATS are forfeited, obstruction of view and impingement of instruments commonly occur. However, the surgical technique is not different, including the identification and division of the vessels and the bronchus, and lymph node dissection. We generally center the camera on the incision, inserting instruments on either side of it; further, for better visualization, the stapler is placed in the thoracic cavity beneath the camera. Conducting extensive surgery through a single, small incision is often ergonomically problematic for surgeons and assistants. During an operation, the operator and the assistant are sometimes superimposed; therefore, it is important to prevent contamination.

We made a utility incision in the 5th intercostal space. The procedure through the 6th intercostal space allows the division of the inferior pulmonary ligament and the inferior pulmonary vein more easily. However, our first step is the dissection of the interlobar space; this approach is easier through the 5th intercostal space. If a conversion to conventional VATS is required, a utility incision in the 5th intercostal space is more convenient because a utility incision in the 5th intercostal space is always used during conventional VATS.

In our experience, this approach is safe, feasible, and reproducible. Although segmentectomy is generally expected to be more difficult than lobectomy, superior, basal, and lingula segmentectomies are more easily executed, owing to the readily defined segmental planes. However, without multiple views through a single incision, the division of segmental planes has to be performed in one direction. Division of segmental planes is slightly difficult during the division of segmental planes in single-incision segmentectomy.

In conclusion, single-incision VATS superior segmentectomy of LLL for early-stage lung cancer was both feasible and safe in this instance. However, its merits in cancer treatment require further study.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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REFERENCES