Changes in Pulmonary Function in Lung Cancer Patients After Video-Assisted Thoracic Surgery

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Background. **Video-assisted thoracoscopic surgery (VATS) is widely performed in patients with resectable non-small cell lung cancer. However, it is unknown whether VATS sublobar resection has advantages compared with VATS lobectomy in preserving pulmonary function.**

Methods. **Three hundred patients with non-small cell lung cancer who underwent VATS were enrolled. Pulmonary function tests were performed three times: preoperatively, and at 3 and 12 months postoperatively. Pulmonary function was compared between the VATS lobectomy group (n = 227) and the VATS sublobar resection group (n = 73).**

Results. **The VATS sublobar resection group had greater preserved pulmonary function than the VATS lobectomy group at 3 and 12 months postoperatively ($p < 0.001$). However, a VATS lobectomy of the right upper or right middle lobe revealed no difference in forced vital capacity (−1.21% versus −1.45%; $p = 0.88$) or the diffusion capacity of carbon monoxide (−3.99% versus −2.45%; $p = 0.61$) compared with VATS sublobar resection after 12 months. In those who underwent VATS of the right lower lobe, forced expiratory volume in 1 second (−8.60% versus −3.69%; $p = 0.12$) was not different between the two groups after 12 months. Video-assisted thoracoscopic surgery lobectomy of the left upper or left lower lobe resulted in lower pulmonary function than VATS sublobar resection ($p < 0.05$).**

Conclusions. **Patients with non-small cell lung cancer who underwent VATS sublobar resection demonstrated greater pulmonary function than those who underwent VATS lobectomy. However, in right-side VATS lobectomy, some differences dissipated at 1 year.**

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Lung cancer is the most common cause of cancer-related death worldwide [1]. Surgery is considered the primary treatment for patients with resectable, early non-small cell lung cancer (NSCLC) [2]. The Lung Cancer Study Group implemented the only randomized study comparing lobectomy and sublobar resection, such as a segmentectomy or wedge resection [3]. The results revealed an increased risk of local recurrence and reduced survival in patients who underwent sublobar resection. Furthermore, there was no advantage in postoperative pulmonary function after sublobar resection. This study established lobectomy as the gold standard treatment for resectable NSCLC.

However, these results have been challenged in recent years. The development of surgical skills and increased identification of small cancers by low-dose computed tomography screening have naturally led surgeons to resect lung parenchyma to a lesser extent [4]. At present it is suggested that sublobar resection can produce comparable recurrence and survival rate results for patients with stage 1A NSCLC [5–7]. Sublobar resection might be favorable in preserving pulmonary function compared with lobectomy [8, 9]. However, changes in pulmonary function according to chronology and the resected lobe have not been previously investigated between the two surgical methods.

Since the early 1990s, video-assisted thoracoscopic surgery (VATS) has been used for several diagnostic procedures and resections of small, peripheral lung nodules [10]. Recently, VATS has gained widespread acceptance for lung cancer surgery [11]. Video-assisted thoracoscopic surgery can be performed through small incisions and results in less postoperative pain, fewer adhesions, and faster recovery [12, 13]. With respect to pulmonary function, VATS lobectomy outperformed open thoracotomy [14–16]. However, it is unknown whether VATS sublobar resection has advantages compared with VATS lobectomy with respect to pulmonary function.

In this study, we compared postoperative pulmonary function between patients who underwent VATS

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Abbreviations and Acronyms

DLCO = diffusion capacity of carbon monoxide
FEV_1 = forced expiratory volume in 1 second
FVC = forced vital capacity
NSCLC = non-small cell lung cancer
PFT = pulmonary function test
RLL = right lower lobe
RML = right middle lobe
RUL = right upper lobe
VATS = video-assisted thoracoscopic surgery

lobectomy versus VATS sublobar resection according to chronology and the resected lobe.

Patients and Methods

Patients

A registry and management protocol were started in August 2003 for patients with NSCLC who underwent surgery at Seoul National University Bundang Hospital. Pulmonary function tests (PFTs) were performed at least three times: preoperatively, and at 3 and 12 months postoperatively. From August 2003 to December 2012, 1,799 patients were enrolled in the registry. Among them, 900 patients underwent VATS lobectomy or VATS sublobar resection, which included VATS segmentectomy and VATS wedge resection. We excluded patients with any missing PFT data, a simultaneous resection of more than two lobes, pleurodesis because of pleural effusion or pneumothorax, inhaler use because of chronic obstructive pulmonary disease or asthma, interstitial lung disease or atelectasis on a chest computed tomography, and sustained smoking after VATS. Finally, 300 patients were enrolled (Fig 1). Baseline PFT values were not significantly different between the enrolled patients and those excluded because of missing PFT data.

Video-Assisted Thoracic Surgery

Video-assisted thoracic surgery was performed through three ports. Two incisions were used for a 10-mm thoracoscopic port and a 5-mm surgical instrument port. A utility window was made along the anterior axillary line of the fourth or fifth intercostal space. Rib cutting or rib spreading was not used. Systematic mediastinal lymph node dissection was performed. The choice of surgical approach, such as VATS lobectomy or VATS sublobar resection, was chosen by the surgeon while considering NSCLC stage, tumor size, tumor location, patient age, and pulmonary function.

The Institutional Review Board of Seoul National University Bundang Hospital approved this study (B-1401/234-105).

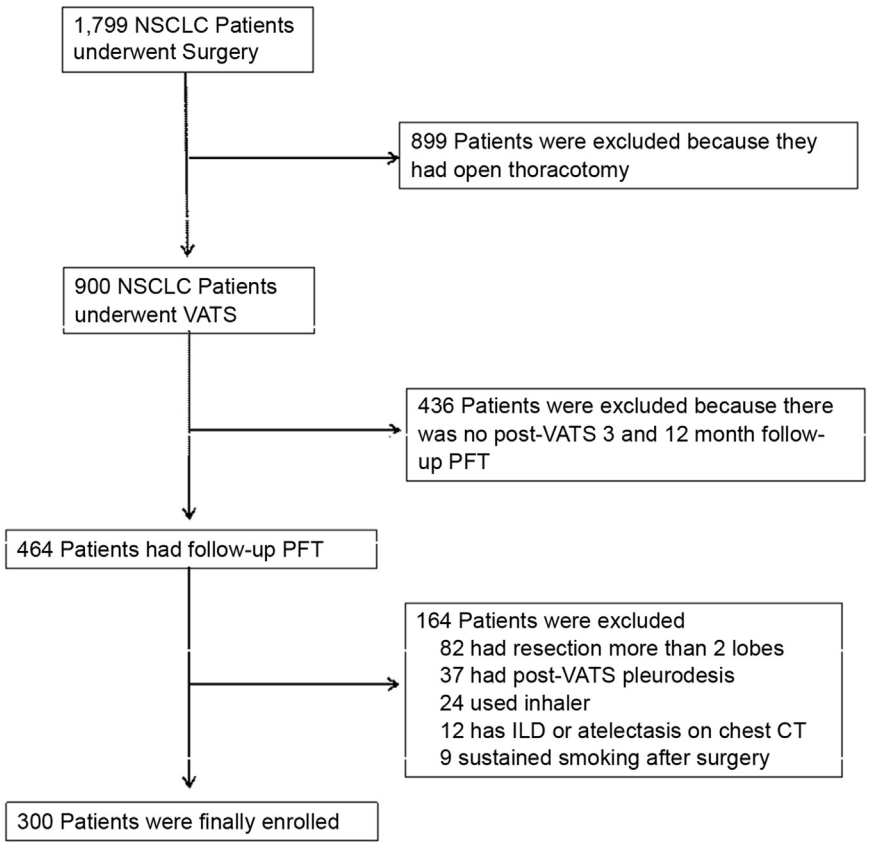

Fig 1. Study enrollment flow chart. (CT = computed tomography; ILD = interstitial lung disease; NSCLC = non-small cell lung cancer; PFT = pulmonary function test; VATS = video-assisted thoracoscopic surgery.)