Editorial

Minimally invasive sleeve lobectomy: it is important to pass excellent techniques to the next generation

Kazuo Nakagawa

Department of Thoracic Surgery, National Cancer Center Hospital, Tokyo, Japan

Correspondence to: Kazuo Nakagawa, MD. Department of Thoracic Surgery, National Cancer Center Hospital, 5-1-1, Tsukiji, Chuo-ku, Tokyo 104-0045, Japan. Email: kznakaga@ncc.go.jp.

Comment on: Zhang C, Yu Z, Li J, *et al.* Hybrid video-assisted thoracoscopic surgery sleeve lobectomy for non-small cell lung cancer: a case report. J Thorac Dis 2020;12:6836-46.

Keywords: Lung cancer; sleeve lobectomy; minimally invasive approach

Submitted Jan 24, 2023. Accepted for publication Feb 04, 2023. Published online Feb 22, 2023.
doi: 10.21037/jtd-23-71
View this article at: https://dx.doi.org/10.21037/jtd-23-71

Recently, minimally invasive approaches have been widely applied to surgery for lung cancer, particularly early-stage lung cancer, and several studies have demonstrated the usefulness of these approaches compared to conventional thoracotomy (1). These minimally invasive approaches are sometimes used for more complicated lung cancer surgery, such as bronchial sleeve lobectomy (2,3). There are several types of minimally invasive approaches, and they are generally classified into video-assisted thoracic surgery (VATS) including uniportal VATS and multiportal VATS, hybrid VATS, and robotic-assisted thoracic surgery (RATS) (4). Minimally invasive approaches have become a landmark in the era of minimally invasive surgery. However, few studies have investigated the differences between these minimally invasive approaches in terms of invasiveness, safety, and oncological quality, not only in surgery for early-stage lung cancer, but also in complicated lung cancer surgery (1). Accordingly, thoracic surgeons do not yet know which approaches are the most appropriate for sleeve lobectomy for lung cancer.

To date, several studies, including review articles and meta-analyses, have compared VATS sleeve lobectomy to sleeve lobectomy through conventional thoracotomy (open sleeve lobectomy). In a systematic review and meta-analysis, Zhong and colleagues included 281 patients with VATS sleeve lobectomy and 369 with open sleeve lobectomy (5). There was no significant difference in intraoperative blood loss, number of resected lymph nodes, chest drainage time, morbidity or mortality between the two groups. In addition, a shorter postoperative hospital stay was observed in VATS sleeve lobectomy, with marginal significance. In contrast, VATS sleeve lobectomy was associated with a longer operative time. In terms of prognosis, VATS sleeve lobectomy achieved overall survival (OS) comparable to that with open sleeve lobectomy. Deng and colleague also conducted a meta-analysis to compare the outcomes with VATS sleeve lobectomy to open sleeve lobectomy, and reported similar results (6). Thus, from the viewpoint of retrospective comprehensive analyses, although VATS sleeve lobectomy needs a longer operative time, the surgical and oncological outcomes with VATS sleeve lobectomy were similar to those with open sleeve lobectomy. However, several concerns have been pointed out. First, the major difference between VATS sleeve lobectomy and open sleeve lobectomy is the size of the incision, with otherwise nearly the same procedures for resection, reconstruction, and lymph node dissection. However, it remains unclear whether reducing the size of the incision really gives patients any benefits, such as decreasing morbidity or prolonging survival, even in highly select patients with VATS sleeve lobectomy (7). Second, all of the studies that were considered in these analyses were carried out in China, and whether similar results would be observed in other countries needs further investigation.

As an another minimally invasive procedure for sleeve lobectomy, Zhang and colleagues reported right upper

sleeve lobectomy with pulmonary artery (PA) plasty for a 49-year-old male with clinical N2 adenocarcinoma after induction chemotherapy (8). The surgical approach was a hybrid VATS with an anterolateral 8cm incision in the 5th intercostal space using an incision protection retractor without rib spreading. A 1cm camera port was placed in the posterior axillary line of the 8th intercostal space. During surgery, since the tumor and N1 lymph nodes infiltrated the ascending A2 and A3a, after the ascending A2 and A3a were divided with scissors, direct closure was performed using a running suture with 5-0 prolene. Next, end-to-end anastomosis of the right main bronchus to the intermediate bronchus was performed using a twin-needle stitch and bi-directional continuous full-thickness 4-0 prolene suture. The surgical procedures were common for sleeve lobectomy with PA plasty. They concluded that hybrid VATS sleeve lobectomy provided an excellent operative field, a safe and easy anastomosis, and a shorter operative time. More recently, those authors also conducted a retrospective study that compared the efficacy and safety of hybrid VATS sleeve lobectomy to those of open sleeve lobectomy for non-small cell lung cancer (NSCLC) using a propensity score matching method (9). In their study, hybrid VATS sleeve lobectomy was associated with a significantly shorter postoperative hospital stay and chest drainage time. Furthermore, no differences in 30- or 90-day mortalities were observed between the two procedures. Additionally, no significant differences in 3-year OS or 3-year recurrence-free survival (RFS) were found between the two procedures. They concluded that hybrid VATS sleeve lobectomy may be safe and feasible and is associated with a similar oncologic prognosis and better postoperative recovery compared with open sleeve lobectomy for NSCLC.

In the hybrid VATS approach, thoracic surgeons perform surgical procedures through both direct vison and thoracoscopic vision. The length of the skin incision can be extended from 5 to 8 cm depending on the status of lung cancer, the difficulty of the surgical procedures, the surgeons` skill and that of the other members of the operative team. The most important advantage of the hybrid VATS approach is that it can be easily converted to standard thoracotomy in an emergency such as PA injury (1). Accordingly, it is reasonable that operative procedures would begin thorough a hybrid VATS approach and this should be maintained as much as possible. However, if this is not possible, the surgical approach can be easily converted to thoracotomy. Accordingly, a hybrid VATS approach may be appropriate even for complicated lung cancer surgery in the era of minimally invasive surgery.

In terms of other minimally invasive approaches, the efficacy of robotic sleeve lobectomy in comparison with VATS sleeve lobectomy and open sleeve lobectomy has also been evaluated (10). In a study by Qiu and colleague, compared with VATS and open techniques, robotic sleeve lobectomy gives a similar oncologic outcome for patients with centrally located NSCLC. They concluded that robotic sleeve lobectomy is a safe, feasible, and effective procedure. The most remarkable finding in their study was that the mean time required for bronchial anastomosis using a robotic technique ranged from 21 to 27 minutes, which was comparable to those for the VATS and open procedures. A robotic surgical system with tiny wristed instruments and 3-dimensional magnified vision might enable surgeons to perform precise manipulation.

Despite the efficacy of minimally invasive sleeve lobectomy, thoracic surgeons should pay attention to several concerns. First, in complicated lung cancer surgery through a minimally invasive approach, thoracic surgeons should always keep in mind the decision criteria and timing for conversion to thoracotomy and share them with their surgical team. Conversion rates in two recent studies that included more than 100 patients with VATS sleeve lobectomy were 2.9% and 4.5%, respectively (2,3). In contrast, in recent studies using the European Society of Thoracic Surgeons (ESTS) database and the U.S. National Cancer Data Base (NCDB), these values were 24.5% and 20.5%, respectively (11,12). Thus, conversion rates vary among previous studies. These findings imply that VATS sleeve lobectomy can be safely completed based on appropriate indications with skillful surgical procedures. For that purpose, thoracoscopy should be used to reassess the appropriateness and feasibility of a minimally invasive procedure intraoperatively. Uncontrolled hemorrhage remains the most dangerous and fatal complication during VATS sleeve lobectomy, and can impair postoperative recovery after minimally invasive surgery. Large, bulky, centrally located tumor often involves the hilum, which might lead to catastrophic loss of control at the level of the main PA. Thoracic surgeons should also avoid situations in which the surgical and oncological quality of the surgery are compromised as a result of persisting in a VATS approach.

Second, the use of sleeve lobectomy in lung cancer surgery is relatively rare (13). In the ESTS database study, 1,652 patients with sleeve lobectomy from 2007 to 2021 were evaluated. The data were collected from 270 thoracic surgery units in 25 European countries (11). The

number of sleeve lobectomy procedures performed at each institute per year may be small. In the NCDB study, only 210 patients with sleeve lobectomy were collected from 2010 to 2015 (12). In a Japanese survey, among 45,243 surgeries for pulmonary malignancy, only 474 (1.0%) sleeve lobectomies were performed in 2018 (14). In contrast, among 31,592 surgeries for pulmonary malignancy, 441 (1.4%) sleeve lobectomies were performed in 2009 (15). Thus, in recent years, although the number of surgeries for lung cancer has increased, the frequency of sleeve lobectomy has gradually decreased. In addition, the total number of sleeve lobectomy procedures might decrease, and the number of more complicated sleeve lobectomy procedures might increase due to the development of new drugs and combination therapies. Surely, VATS sleeve lobectomy and hybrid VATS sleeve lobectomy seem to be ideal in the era of minimally invasive surgery. However, to master these surgical techniques, thoracic surgeons have to experience many operations. A study by Xie and colleagues demonstrated that, after years of experience, VATS sleeve lobectomy can be safely performed with a similar operative time and shorter postoperative hospital stay compared with open sleeve lobectomy. In that study, a total of 56 VATS sleeve lobectomies were performed before the study period (3). In contrast, in their study on the efficacy and safety of hybrid VATS sleeve lobectomy, Zhang and colleagues wrote that at least 100 cases of VATS lobectomy and 10 cases of thoracotomy sleeve resection should be accumulated to lay the anatomical and technical foundation before performing hybrid VATS sleeve lobectomy (9). Under these conditions, how many thoracic surgeons can experience a sufficient number of sleeve lobectomies to achieve precise procedures that are necessary for minimally invasive sleeve lobectomy? Furthermore, even in high-volume institutions, if thoracic surgeons with sufficient experience with open sleeve lobectomy performed VATS sleeve lobectomy until they could safely perform the procedures, the next generation of thoracic surgeons may not have opportunities to perform open sleeve lobectomy. This could be a very important issue. The techniques used in sleeve lobectomy absolutely need to be inherited by the next generation of thoracic surgeons. Since they may not have sufficient opportunities to perform open sleeve lobectomy as in the past, from the beginning, they might have to learn how to perform sleeve lobectomy only through a minimally invasive approach. Thoracic surgeons who are proficient with sleeve lobectomy (regardless of the approach used) have a responsibility to pass their knowledge to the next generation.

On the other hand, although almost all of the studies on the subject have stated that a multicenter randomized controlled trial (RCT) will be needed to further explore the safety and effectiveness of VATS sleeve lobectomy (2,3,5,6,9,10), such RCTs might be impossible due to the rarity of these procedures. Furthermore, it does not seem to be meaningful or valuable to evaluate the superiority or inferiority among VATS, hybrid VATS and thoracotomy. Therefore, sleeve lobectomy should be conducted through a favorable approach based on appropriate surgical strategies at each institution. Again, how thoracic surgeons pass complicated procedures, such as bronchial sleeve resection, to the next generation in the era of minimally invasive surgery may be an important issue. At least, a hybrid approach might be more suitable for teaching young surgeons not only the standard procedure but also procedures that are more complicated than other minimally invasive approaches.

In conclusion, sleeve lobectomy can be more invasive than standard lobectomy. Accordingly, thoracic surgeons should always try to make such procedures less invasive. Sleeve lobectomy through a minimally invasive approach can be an effective option. However, the only difference is in the type of approach. The most important things are safety and oncologic quality. Thoracic surgeons should always consider the appropriate balance between the advantages and disadvantages of a minimally invasive approach without compromising safety and oncologic quality.

Acknowledgments

Funding: None.

Footnotes

Provenance and Peer Review: This article was commissioned by the editorial office, *Journal of Thoracic Disease*. The article did not undergo external peer review.

Conflicts of Interest: The author has completed the ICMJE uniform disclosure form (available at https://jtd.amegroups.com/article/view/10.21037/jtd-23-71/coif). The author has no conflicts of interest to declare.

Ethical Statement: The author is accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are

appropriately investigated and resolved.

References

1. Nakagawa K, Yoshida Y, Yotsukura M, et al. Minimally invasive open surgery (MIOS) for clinical stage I lung cancer: diversity in minimally invasive procedures. Jpn J Clin Oncol 2021;51:1649-55.
2. Gao HJ, Jiang ZH, Gong L, et al. Video-Assisted Vs Thoracotomy Sleeve Lobectomy for Lung Cancer: A Propensity Matched Analysis. Ann Thorac Surg 2019;108:1072-9.
3. Xie D, Deng J, Gonzalez-Rivas D, et al. Comparison of video-assisted thoracoscopic surgery with thoracotomy in bronchial sleeve lobectomy for centrally located non-small cell lung cancer. J Thorac Cardiovasc Surg 2021;161:403-413.e2.
4. Migliore M. Video-assisted thoracic surgery techniques for lung cancer: which is better? Future Oncol 2016;12:1-4.
5. Zhong Y, Wang Y, Hu X, et al. A systematic review and meta-analysis of thoracoscopic versus thoracotomy sleeve lobectomy. J Thorac Dis 2020;12:5678-90.
6. Deng HY, Qiu XM, Zhu DX, et al. Video-Assisted Thoracoscopic Sleeve Lobectomy for Centrally Located Non-small Cell Lung Cancer: A Meta-analysis. World J Surg 2021;45:897-906.
7. Deng HY. Sleeve Lobectomy for Centrally Located Non-Small Cell Lung Cancer: Does Incision Size Really Matter? Ann Thorac Surg 2020;109:612.
8. Zhang C, Yu Z, Li J, et al. Hybrid video-assisted thoracoscopic surgery sleeve lobectomy for non-small cell lung cancer: a case report. J Thorac Dis 2020;12:6836-46.
9. Zhang C, Ma Y, Yu Z, et al. Comparison of efficacy and safety of hybrid video-assisted thoracoscopic surgery vs. thoracotomy sleeve lobectomy for non-small cell lung cancer: a propensity score matching study. J Thorac Dis 2022;14:2635-44.
10. Qiu T, Zhao Y, Xuan Y, et al. Robotic sleeve lobectomy for centrally located non-small cell lung cancer: A propensity score-weighted comparison with thoracoscopic and open surgery. J Thorac Cardiovasc Surg 2020;160:838-846.e2.
11. Gonzalez M, Chriqui LE, Décaluwé H, et al. Sleeve lobectomy in patients with non-small-cell lung cancer: a report from the European Society of Thoracic Surgery database 2021. Eur J Cardiothorac Surg 2022;62:ezac502.
12. Mayne NR, Darling AJ, Raman V, et al. Perioperative Outcomes and 5-year Survival After Open versus Thoracoscopic Sleeve Resection for Lung Cancer. Semin Thorac Cardiovasc Surg 2021;33:522-30.
13. Chudgar NP, Huang J. Commentary: Evaluating Thoracoscopic Sleeve Lobectomy-Is Big Data Up to the Challenge? Semin Thorac Cardiovasc Surg 2021;33:531-2.
14. Committee for Scientific Affairs, The Japanese Association for Thoracic Surgery, Shimizu H, Okada M, et al. Thoracic and cardiovascular surgeries in Japan during 2018 : Annual report by the Japanese Association for Thoracic Surgery. Gen Thorac Cardiovasc Surg 2021;69:179-212.
15. Committee for Scientific Affairs, Sakata R, Fujii Y, et al. Thoracic and cardiovascular surgery in Japan during 2009: annual report by the Japanese Association for Thoracic Surgery. Gen Thorac Cardiovasc Surg 2011;59:636-67.

Cite this article as: Nakagawa K. Minimally invasive sleeve lobectomy: it is important to pass excellent techniques to the next generation. J Thorac Dis 2023;15(3):946-949. doi: 10.21037/jtd-23-71