



# Editorial on “Trans-inferior-pulmonary-ligament VATS basal segmentectomy: application of single-direction strategy in segmentectomy of left S9+10”

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In 1995, the Lung Cancer Study Group Trial revealed an increased risk for local recurrence and a reduced 5-year mortality rate after limited resection compared to lobectomy for stage I non-small cell lung cancer (1). Since then, segmentectomy has always been on trial. Although the conclusiveness of this study was limited by including a significant number of non-anatomic wedge-resections and tumours up to 3 cm, in the guidelines segmentectomy continuous to be regarded only as a compromise solution for patients with reduced respiratory reserve.

However, multiple single-center studies indicate similar rates of morbidity and survival after segmentectomy in tumors less than two centimeters (2,3), and it is realistic to expect that ongoing prospective, randomized studies (CALGB-140503 and JCOG-0802) will confirm these results. Moreover, the emergence of lung cancer screening programs for high-risk patients, as well as enhancements in imaging technology will produce larger cohorts of patients with early-stage lung cancer, potentially suitable for segmental resection (4).

Conventional open segmentectomy of the lung has been a challenging procedure for years demanding usually more advanced operating skills than open lobectomy. The main reason is the difficulty exposing the intersegmental plane which is mandatory for accurate, anatomical, segmental resection (5). The surgical procedure begins with the division of the anatomical structures (vein, artery and bronchus) followed by the blunt or sharp dissection of the segmental parenchyma within the defining borders of the

neighbouring intersegmental veins. In case of segments 1 to 6 and 8 there is a defined anatomic path through the fissures. But for segments 9 and 10 the intraparenchymal localisation requires advanced surgical skills.

As thoracoscopic procedures [video-assisted thoracoscopic surgery (VATS)] and techniques advanced, minimal invasive thoracoscopic segmentectomy gained favor for respiratory compromised patients (6). As the first reports of VATS segmentectomy were documented, radicality and anatomical accuracy of the thoracoscopic technique were controversially discussed. The lack of palpation and sharp dissection of the intersegmental plane in VATS-segmentectomy was considered to be non-anatomical and the use of stapling devices for parenchymal resection was regarded to be a rather extended wedge resection than an anatomical resection. Nevertheless, the thoracoscopic technique for segmental resection using stapling devices has become the standard operating mode for most thoracic surgeons (7). Different techniques have been documented for intersegmental plane resection: inflating/deflating (8), methylene blue chromoendoscopy (9), infrared thoracoscopy with indocyanine green (10). Although the above techniques allow a more thorough and anatomically correct segmental resection, the deep intraparenchymal localisation of the hilar structures for the basal segments of the lung can be the cause of challenging dissection.

Zhu and colleagues acknowledged the special issue of anatomical resection of the basal segments (11). Considering the known fissureless techniques that were

developed for thoracoscopic lobectomy to avoid dissecting the parenchyma in patients with dense fissures, Liu and colleagues developed a “single-direction” procedure that consists in dissecting the structures in order of their appearance and avoiding the division of the fissure (12). In the lower lobes, for example, that means going an inferior-to-superior way consisting in the order of pulmonary ligament, inferior pulmonary vein, lower lobe bronchus and inferior pulmonary artery. In this way it is possible to avoid the conventional technique of dissecting the fissure between upper lobe and lower lobe (or middle lobe in right sided cases). Usually, the dissection of the fissure would be mandatory for the identification of the segment 6 and 8 arteries and bronchi. In addition, after recognizing the above structures a deep intraparenchymal dissection of the segmental 9 and 10 arteries would find place. The same procedure would then take place for the segments 9 and 10 bronchi.

The single direction technique of Zhu and colleagues is a valuable and possibly superior alternative for resection of segments 9 and 10 of the lung. It allows a less challenging path for dissection of the hilar structures. By avoiding the deep intraparenchymal dissection it facilitates the use of stapling devices through easier angulation and minimizes air leakage.

Though innovative and surgically advanced, the technique of Zhu and colleagues can be criticized considering inter- and intra-lobar lymph node dissection. Anatomical segmental resection for lung cancer is considered surgically and oncologically correct, when systematic lymph node dissection has taken place. Avoiding the main interlobar fissure means also avoiding dissection of the station 11 (interlobar) lymph nodes. Although in most cases of segmental resection tumor size is smaller than 2 cm and lymph node involvement is rare, there is always a ratio of about 8–12% for lymph node upstaging (13,14). The most common nodal upstaging in case of segmental resection is in stations 11 and 12.

Conclusively, Zhu and colleagues documented a novel technique for resection of the basal lung segments. Considering the gaining importance of lung cancer screening and daily advancing diagnostic algorithms, segmental resection is here to stay for thoracic surgeons. Different techniques can facilitate anatomical resection but every technique has its pits and falls. Tailored used of different techniques for segmental resection according to patient and intraoperative findings is probably the most objective and safe manor to deal with challenging

segmentectomies.

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## Footnote

*Conflicts of Interest:* The authors have no conflicts of interest to declare.

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