



Uniportal versus multiportal VATS segmentectomy: less is more?

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In a recent issue of *Translational Lung Cancer Research*, Zhou and colleagues (1) reported on contemporary perioperative and oncological outcomes for uniportal video-assisted thoracoscopic surgery (VATS) segmentectomy for non-small cell lung cancer (NSCLC), compared to the three-port conventional VATS technique. They described the largest sample size so far with a cumulative number of 2,630 patients. Of these, 400 (15%) patients underwent uniportal VATS segmentectomy while the remaining 2,230 (85%) underwent three-port VATS segmentectomy, all for stage IA NSCLC. After propensity score matching, 400 uniportal VATS segmentectomies were compared to 1,600 three-port VATS segmentectomies for final analysis.

In search of the least invasive technique, uniportal VATS was introduced in the early 2000s. The uniportal approach was, during its early adaptation, associated with prolonged operation time, a higher risk of complications (including perioperative hemorrhage), and conversion to thoracotomy in comparison to a multiportal approach. Conversely, more recent studies have shown that both approaches are at least comparable regarding safety outcome, conversion rate, operating time, and completeness of lymphadenectomy for lobectomies (2). Although these techniques are comparable on different parameters, benefits of a single incision approach include reduced pain, shorter chest tube drainage duration and shorter hospitalization (2-4).

Segmentectomies, as performed by Zhou and colleagues, are considered to be technically more challenging compared to lobectomies, in part due to larger variations in (sub)

segmental anatomy. High-volume training is necessary to gain sufficient proficiency. Zhou and colleagues (1) defined a minimal annual caseload of 70 procedures to be a so-called high-volume surgeon. This annual caseload is comparable to the proposed 64–71 required cases as presented in a learning curve study on uniportal VATS segmentectomy (5).

Segmentectomies can be categorized into simple versus complex procedures based on the location of the segment(s) and associated number of intersegmental planes. Simple segmentectomies are commonly defined as resection of segment S6 (left or right lower lobe), S1-S2-S3 (trisegmentectomy of the left upper lobe) or S4-S5 (lingulectomy). Zhou and colleagues (1) also defined segmentectomy of all combined basal segments (S7-S8-S9-S10) as simple. All other segmentectomies were defined as complex. These complex segmentectomies are associated with a higher risk of complications (6,7). Though, it must be noted that these particular studies included segmentectomies via thoracotomy as well as VATS (both multiportal and uniportal). When comparing uniportal to multiportal VATS segmentectomies, several studies have found favorable outcomes for the uniportal approach regarding postoperative complications, duration of surgery, chest tube drainage and length of hospital stay, even in complex segmentectomies (8,9). Others found comparable clinical outcomes between both techniques (10,11). Zhou and colleagues (1) reported a lower amount of intraoperative blood loss and longer operative time when using uniportal VATS compared to multiportal VATS for complex

segmentectomy. Furthermore, in their study, uniportal VATS segmentectomies induced no more perioperative complications compared to those via a multiportal approach, supporting the safety of dissection and stapling techniques for segmentectomy through a single incision.

In order to aid segmentectomies, different techniques are employed, including the use of three-dimensional reconstruction of segmental bronchi, arteries and veins based on computed tomography (CT) images for preoperative planning and identification of anatomic variations, but also localization of the tumor and its resection margin. CT guided hookwire or microcoil placement may help to localize non-palpable tumors, downgrade the need for bi- or trisegmentectomies for adequate margin, and is suggested to reduce operating time (12,13). The risk of these techniques is dislocation. In addition, several other localization techniques have been described such as intraoperative ultrasound, dyes, contrast injections and tracers. All come with their own advantages and disadvantages, and are generally used on the surgeon's discretion. In time, uniportal robot-assisted and navigation-guided segmentectomy may overcome many of the unique disadvantages, especially in complex segmentectomies and non-palpable tumors.

An important oncologic aspect concerns the feasibility to perform adequate lymph node dissection when performing uniportal segmentectomy. The European Society of Thoracic Surgeons recommends resection of at least six lymph nodal stations (including hilar, interlobar and mediastinal nodes) for proper pathological classification and oncologic safety (14). Several studies have proven the feasibility of nodal dissection in segmentectomies through both a multiportal and uniportal approach (15,16). Zhou and colleagues (1) harvested a similar number of lymph nodes using both techniques (6.38 ± 2.97 vs. 6.70 ± 3.53 , $P=0.11$), but fewer lymph node stations were harvested in uniportal setting (4.43 ± 1.53 vs. 4.68 ± 1.98 , $P=0.02$). The reason for this difference remained unclear, yet the absolute difference was only small and clinical relevance questionable. Furthermore, this did not translate in differences in 5-year overall survival or 5-year progression-free survival.

Although cohort studies such as the study of Zhou and colleagues have methodological issues, they are of important value. Randomized controlled trials to compare uniportal to multiportal VATS segmentectomies may be seen as methodologically superior but are hardly feasible due to the required sample size, and extrapolation of results are often hindered by selection bias. The data reported by Zhou *et al.*

clearly confirm uniportal VATS segmentectomy to be a safe and effective technique for the treatment of early-stage lung cancer.

In conclusion, uniportal VATS segmentectomy is a safe procedure when performed by experienced surgeons and is associated with comparable oncological results compared to a multiportal approach.

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Ethical Statement: The authors are 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.

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