

Robotic-assisted thoracoscopic segmentectomy: there is a long way to go

Chengqiang Li, Hecheng Li

Department of Thoracic Surgery, Ruijin Hospital Shanghai Jiao Tong University, School of Medicine, Shanghai 200025, China

Correspondence to: Hecheng Li, MD, PhD. Chair, Department of Thoracic Surgery, Ruijin Hospital Shanghai Jiao Tong University, School of Medicine, 197 Ruijin Er Road, Shanghai 200025, China. Email: lihecheng2000@hotmail.com.

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We appreciate the reviewer's excellent comments regarding robotic-assisted thoracoscopic S6 segmentectomy (1). We agree that there is no standardized technique for the video-assisted thoracic surgery (VATS) approach, but without a doubt, the future of surgery is going in the direction of single port access and robotics. The advantages of robotic VATS (R-VATS) over conventional VATS include an additional four degrees of freedom (internal pitch, internal yaw, rotation, and grip), elimination of the fulcrum effect, superior 3-D vision from the binocular camera, tremor filtration, and improved ergonomic positioning for the surgeon (2-4). The 5-year overall survival of stage I non-small cell lung cancer for the robotic, VATS, and open matched groups were 77.6%, 73.5%, and 77.9%, respectively, and there was no statistically significant difference between the groups (5). However, R-VATS has been associated with reductions in mortality, length of hospital stay, and overall complication rates when compared to both open and VAT surgeries (6).

In your comments, you referred to a study that suggested that R-VATS was associated with a higher rate of intraoperative conversion when compared with the VATS approach (7). However, in that study, the difference in the conversion rate was not statistically significant (19.2% *vs.* 8.4%, $P=0.4189$), and the reasons for conversion in the robotic-assisted lobectomy group were bleeding from a pulmonary artery with emergent conversion in one patient and four non-emergent conversions due to safety (two minor bleedings, one atypical anatomy, and one extended resection).

These conversions could be avoided with additional training. Other studies have shown no differences in the conversion rates from the R-VATS and VATS groups (5,8,9), albeit with higher conversion rates for the first 30 R-VATS.

Segmentectomy is widely accepted as an alternative procedure to treat stage IA non-small cell lung cancers that are 2 cm or less in low-risk and high-risk patients as this method preserves lung function with a similar prognosis (10-12). Management of the intersegmental plane, but not the intersegmental vein, remains controversial. The intersegmental vein should be preserved because it is a landmark for the intersegmental plane, which is in the central portion around the hilum, and because sacrificing the segmental vein could impair gas exchange leading to a reduction in pulmonary function. However, if the margin from the tumor is considered insufficient, the intersegmental vein should be removed without hesitation (13,14). Three techniques, stapling, electrocautery, or a combination of stapling and electrocautery, are used to cut the intersegmental plane. Stapling is easy and may reduce the rate of postoperative air leakage; however, it is expensive and may result in reduced postoperative pulmonary function as it may cause shrinkage of the preserved segment (15,16). If the intersegmental plane is closed with a linear staple line during a simple segmentectomy, such as an S6 segmentectomy, the reduction in lung volume or function can be minimized (17). Dissection of the segmental plane by electrocautery is strongly recommended because it offers some advantages, including full expansion of the residual

segments and easier assessment of surgical margins (13-16). Air leakage was found to be an issue after segmental resection in one study (13), but it can be easily remedied with a plane pleural closure or a mesh-cover for the intersegmental plane, which successfully blocks air leakage from an opened intersegmental plane up to 30 cm H₂O of airway pressure (16,18,19). The method of cutting the shallow lung tissue with electrocautery and cutting the deep lung tissue with a stapler is widely used because it effectively prevents air leakage and preserves pulmonary function (16,20). The robotic approach resulted in greater lymph node assessment (5) when compared to conventional VATS (6,9,10). The strategy for lymph node dissection and selection of lymph nodes for intraoperative frozen section is described in the “segmentectomy Bible” (21). Only one randomized controlled trial has shown that sublobar resection was inferior with regards to prognosis when compared with lobectomy (22), and in this trial, more than 30% of the sublobar resections were wedge resections for tumors up to 3 cm in diameter. In contrast, other studies have consistently shown that the prognoses of segmentectomy and lobectomy are similar (10,12,23). The Japanese Cancer Oncology Group (JCOG) 0802 will clarify this controversy in the future (24).

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Footnote

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