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Commentary: Robot-assisted segmentectomy is safe and expensive—What is the debate?

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In this issue of the *Journal*, Zhang and colleagues¹ present their perioperative analysis of outcomes after segmentectomy for early stage non–small cell lung cancer (NSCLC), contributing to the ongoing debate around the potential benefit and cost-effectiveness of robot-assisted thoracic surgery (RATS). Their conclusions state that a robotic approach is safe and effective for typical and atypical segmentectomy when compared with video-assisted thoracic surgery (VATS), but we already knew that.

This article focuses on improved N1 node retrieval as a potential benefit of RATS, despite failing to find a difference in nodal upstaging. The clinical relevance of this finding is uncertain—without changing clinical stage I disease to pathologic stage II, the adjuvant treatment strategy for most patients remains unchanged.

Zhang and colleagues¹ reported similar operative times, but it is not clear whether the reported times represented surgical time or total operating room time. Positioning and docking of the robotic equipment contributes to nonoperative anesthesia time, which may increase the potential for exposure and medication. Inefficiency of total operating time leads to increased turnover delay and cost,² and most comparative studies report longer operative times for robotic lobectomies.³ The initial investment and subsequent maintenance of the platform are substantial financial burdens that may again increase in association with a platform update—the da Vinci Xi model (Intuitive Surgical, Sunnyvale, Calif) was released only 5 years after the Si.⁴ Deen and associates⁵ calculated an overall cost increase of more than \$3000 per RATS

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CENTRAL MESSAGE

Robot-assisted segmentectomy is safe but expensive and has not been shown to provide clinical benefits relative to video-assisted thoracoscopic surgery.

lobectomy or segmentectomy relative to VATS, and even excluding capital depreciation, the total cost increase remained in excess of \$2000 per case.

We must also keep in mind that reports from high-volume tertiary centers with significant robotic experience may not reflect the exposure available at smaller hospitals across the country. Zhang and colleagues¹ propose that VATS techniques involve counterintuitive hand movements and a steep learning curve, but the typical trajectory of current thoracic training generally involves competence in VATS before learning robotic techniques, for which there is significant training involved for the entire team. This may be compounded by less available robot operating room time if there is only one system available at a given hospital.

Finally, it would be helpful to have information regarding the ground glass opacity versus solid components of tumors removed, because inability to palpate the tumor directly is another potential limitation of the robotic approach.⁶ Overall, this study restates the safety of RATS segmentectomy, but it does not address the added expense or describe any patient-driven advantages. The fact remains that robot-assisted lung resection is an expensive technology that does not improve clinical care.

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Commentary: Video-assisted thoracoscopic surgery versus robotic assisted surgery: Are we asking the right question?

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CENTRAL MESSAGE

Both video-assisted thoracoscopic and robotic segmentectomy are effective and safe in the hands of expert surgeons in treating early lung cancer.

Minimally invasive surgical approaches are steadily replacing thoracotomy in early lung cancer. Video-assisted thoracoscopic surgery (VATS) is safe and oncologically equivalent to open surgery,¹⁻³ demonstrating less postoperative pain, shorter hospital stay, and decreased blood loss.⁴⁻⁶ However, technical challenges, such as dissection of small yet variable segmental bronchovascular structures and the intersegmental plane, result in a steep learning curve that may hinder the adoption of VATS for segmentectomy. In contrast, robotic-assisted surgery (RAS) has gained a more rapid adoption potentially due to improved optics and small-wristed instruments that facilitate complex operative movements. Nevertheless, most studies demonstrate equivalent short-term safety profiles but higher costs associated with RAS.^{7,8} The article by Zhang and colleagues⁹ similarly, aims to compare short-term outcomes and cost between the VATS and robotic segmentectomy. Using a

large cohort and propensity matching, this retrospective study from multiple institutions demonstrates equivalent perioperative outcomes but increased indirect costs associated with the RAS approach. The study also demonstrates improved dissection of N1 nodes with the RAS approach that may have a potential long-term oncological benefit, although no significant difference in upstaging was demonstrated in this study.

The study has a few limitations. First, although patients were propensity matched, a retrospective review of cases performed by a handful of surgeons could be prone to selection bias. Second, whereas the authors should be commended for the large volumes, generalizability of the study to thoracic surgeons who may lack similar clinical volume is limited. It is also unclear from the study whether the outcome during the learning curve of the surgeons was accounted for in the analyses. Finally, the interinstitution variability of the pathologist reviewing the cases could have introduced difference and bias in nodal station and number, thus affecting the outcome. Despite these limitations, the article provides

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