



# Learning Robotic-Assisted, Minimally Invasive Esophagectomy: A Marathon, Not a Sprint

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Trimodality therapy, incorporating esophagectomy after induction chemoradiation, has been shown to provide the highest chance for esophageal cancer patients to achieve long-term survival.<sup>1</sup> Despite the oncologic benefit of surgical resection, esophagectomy has a high rate of postoperative morbidity. Data from the Society of Thoracic Surgeons (STS) General Thoracic Surgery Database demonstrate that among board-certified, thoracic surgeons, esophagectomy is associated with a 33.7% rate of major morbidity.<sup>2</sup> Minimally invasive esophagectomy (MIE) has been shown to decrease the morbidity compared to open esophagectomy.<sup>3</sup> However, nonrobotic MIE remains a technically challenging operation, which has been a barrier to widespread adoption. Robotic-assisted surgery offers several advantages that have facilitated increased adoption of MIE.<sup>4,5</sup> In fact, robotic assisted MIE (RAMIE) is now the most common minimally invasive approach to esophagectomy for cancer.<sup>2</sup> Furthermore, several studies have shown RAMIE to be associated with increased lymph node harvest compared with nonrobotic MIE as well as a possible survival advantage as suggested in a recent meta-analysis published in the *Annals of Surgery*.<sup>6,7</sup> Nevertheless, concerns remain regarding safe adoption of RAMIE; some authors suggest a higher anastomotic leak rate with RAMIE compared with MIE.<sup>8</sup> Never has it been more important to understand the RAMIE learning curve and its impact on postoperative and long-term oncologic outcomes.

In this issue of the *Annals of Surgical Oncology*, Duan et al.<sup>9</sup> seek to better define the RAMIE learning curve in the setting of robotic-assisted McKeown esophagectomy. The authors not only evaluated the typical metrics included in surgical learning curve studies—operative time, complications, length of stay, etc.—but they focused on the quality of lymph node dissection, specifically at the left recurrent laryngeal nerve, as a surrogate for proficiency. I commend the authors for this study design. Quality of lymph node dissection is a critical oncologic metric, which has been shown to correlate with survival following esophagectomy.<sup>10</sup> By including lymph node harvest as a metric for learning curve, this study provides information not only on perioperative outcomes, but also insights into how the RAMIE learning curve may impact long-term oncologic outcomes. The take-home message is that proficiency for RAMIE takes time, potentially as many 240 cases for a single center.

It is important to differentiate competency from proficiency. The former describes a surgeon's ability to safely utilize a particular approach for an operation independently.<sup>11</sup> Proficiency is an ongoing process to maximize efficacy, efficiency, and safety. Duan and colleagues have shown us that achieving proficiency in RAMIE requires high case volume, with incremental improvement continuing over several hundred cases, and the learning curve is indeed the proverbial marathon rather than a sprint. That said, there are several important unknowns in the present study that will invariably impact learning curve. We do not know the individual surgeons' robotic experience levels, the extent to which simulation was used, whether proctors were involved, the extent of overall prior esophagectomy experience, or whether the surgeons also performed robotic-assisted benign esophageal or nonesophageal thoracic operations in their practice. Each of these factors would impact the time to proficiency and should be taken into account when evaluating RAMIE learning curve.

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Adoption of RAMIE for the treatment of esophageal cancer is increasing rapidly.<sup>2</sup> It is our responsibility as esophageal surgical oncologists to study the impact of this technology. We must consider the critical lesson from the present study: the learning curve matters, and it matters for both short-term perioperative and long-term oncologic outcomes. Studies evaluating the efficacy and safety of RAMIE (or any surgical technique for that matter) must take the learning curve into account. Surgeon and center volume and experience should be reported. Comparing one technique performed by surgeons early in their adoption to another technique performed by highly proficient surgeons is comparing apples to oranges. More importantly increased research and resources are needed to develop effective adjuncts to shorten the learning curve so that more patients can receive the maximally safe and efficacious operation.

**DISCLOSURE** ELS—Consultant, Intuitive Surgical.

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