



Three Tenets of Surgeon Quality: Medically Fit Patient, Surgically Resectable Tumor, and Oncologic Benefit from Resection

Catherine G. Pratt, MD, and Robert M. Van Haren, MD, MSPH

Division of Thoracic Surgery, Department of Surgery, University of Cincinnati College of Medicine, Cincinnati, OH

The central dogma of curative oncologic surgery has focused on high-quality surgery that includes complete resection of tumor, adequate lymph node dissection, and minimization of postoperative morbidity and mortality. This is true in lung cancer, which is the most common cancer in both men and women worldwide and the leading cause of cancer mortality.^{1,2} High-quality surgery is critical for best survival in early-stage non-small cell lung cancer (NSCLC), and differences in surgeon-level factors, such as positive margins, inappropriate extent of lung resection, and inadequate lymph node dissection, are associated with worse outcomes.^{3–5}

However, surgeon quality is more than just a completely resected cancer. Surgeon decision making is critical to determine who is medically fit for an operation and who will benefit oncologically from a cancer resection. Surgeons also need to include patients' preferences into this decision-making process. Surgeons need to address all three tenets, i.e. a medically fit patient, a surgically resectable tumor, and an oncological benefit from resection, to be successful. Without all three principles upheld, curative intent is unlikely to be achieved. As oncologic treatments continue to develop, so too is surgical technique refined to suit the nature of each individual malignancy and patient.

In their recent study, Ray et al. and the Mid-South Quality of Surgical Resection Consortium evaluated surgeon-specific factors, their association with survival, and processes of care mitigation.⁶ They hypothesized that processes of care are more readily remedied than patient-specific risk

factors related to disparities in NSCLC survival. Thus, they evaluated four resection-specific factors: (1) positive margins (utilizing the International Association for the Study of Lung Cancer [IASLC] definition for negative margins⁷); (2) non-examination of lymph nodes; (3) non-examination of mediastinal lymph nodes; and (4) wedge resections.

The study covered an 11-year period, with 3959 lung cancer resections within a single consortium of 12 hospitals. Thirty-nine high-volume (>15 resections) surgeons were included (2 general surgeons, 30 board-certified cardiothoracic surgeons, and 7 dedicated general thoracic surgeons), while 21 low-volume surgeons were excluded (3 general surgeons, 15 cardiothoracic surgeons, and 3 general thoracic surgeons). A lymph node specimen collection kit was implemented to improve the quality of lymph node dissection for all surgeons.

During the period prior to lymph node collection kit implementation, the four defined resection-specific factors were studied among surgeons. Utilizing the 25th and 75th percentiles of each metric, a scoring system with defined cut points was created. This was then employed to evaluate post-implementation surgeons and categorize each into one of three tiers based on aggregate intraoperative performance. The lowest (Tier 1) represented a cumulative performance score below the 25th percentile, while the highest (Tier 3) represented a cumulative performance score above the 75th percentile.

Some differences between the pre- and post-kit implementation resections in terms of clinical stage (higher proportion of stage I patients in the post-implementation group) and surgical approach (fewer robotically assisted and more video-assisted resections in the post-implementation group) were identified. However, all resection-specific factors evaluated improved across all tiers post-implementation. Most surgeons were identified as top tier (Tier 3) and met the criteria for greater than the 75th percentile of pre-implementation resections, and Tier 3 surgeons

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R. M. Van Haren, MD, MSPH
e-mail: vanharrm@ucmail.uc.edu

were more likely to have higher utilization of process of care (positron emission tomography [PET], invasive mediastinal staging, minimally invasive surgery). Overall, Tier 3 was associated with best 5-year survival. Notably, patients who underwent resection by Tier 1 surgeons were more likely to be Black and insured under Medicare.

Additionally, there was a significant difference in both the absence of lymph node examination (60%, 72%, and 20% in Tiers 1, 2, and 3, respectively; $p < 0.001$) and mediastinal lymph node examination (73%, 84%, and 24% in Tiers 1, 2, and 3, respectively; $p < 0.001$) among wedge resections across the tiers. Only 7% in Tier 1, 4% in Tier 2, and 40% in Tier 3 had two or more mediastinal lymph node stations sampled. One critical component of high-quality oncologic resection includes lymph node dissection. Currently, both the National Comprehensive Cancer Network (NCCN) and American Cancer Society (ACS) guidelines recommend station-based sampling of at least three N2 and one N1 nodal stations.^{8,9} The recent CALB/Alliance 140503 and JCOG0802 studies have emphasized the critical nature of nodal sampling in relation to sublobar resection.^{10,11} Importantly, both studies followed strict intraoperative protocols, including confirmation of negative lymph nodes on frozen pathology of three (JCOG0802) or two (CALB/Alliance 140503) mediastinal lymph node stations.^{10,11} As these new studies indicate that it is acceptable to perform sublobar resections in select cases, it is interesting to see a trend that surgeons performing wedge resections are more likely to leave nodes unexamined. This serves as a poignant reminder that surgeons must perform high-quality operations regardless of the extent of lung resection, and also raises concerns regarding whether the strict intraoperative protocols employed in such studies will be reliably carried out in practice.

One potential implication of this study is the fundamental difference of patients who underwent resection by Tier 1 surgeons. The cohort treated by surgeons performing in the lowest percentile compared with their peers were made up of higher proportions of Black and Medicare-insured patients. Socioeconomic disadvantages have previously been described as risk factors for poor-long term survival.^{12,13} This could serve as both a confounder of the Tier 1 cohort survival and a potential area for further investigation. A similar point for consideration is the tendency found among Tier 3 surgeons for higher process of care utilization. This raises important questions, such as (1) are socioeconomically disadvantaged patients disproportionately matched with underperforming surgeons, and (2) is there implicit bias among surgeons to perform less adequate surgeries for underrepresented minorities and socioeconomically disadvantaged patients? These are concerning observations that should be answered with future research.

The inclusion of wedge resection as a quality indicator is difficult to interpret in this study given the recent publication of JCOG0802 and CALB/Alliance 140503, which demonstrates no difference in overall survival between sublobar resection and lobectomy.^{10,11} It also returns us to the discussion of the three tenets of surgeon quality: a medically fit patient, a surgically resectable tumor, and an oncologic benefit from resection. It is possible that surgeons executed sound clinical judgment by offering a wedge resection to those patients who had reduced pulmonary function and/or smaller tumors. In fact, most wedge resections were for tumors < 2 cm. Defining surgeon quality without accounting for surgeon decision making has its limitations and reduces surgeons to technicians.

Similarly, the oft-debated R0 resection is arguably the heart of oncologic resection. As referenced in the discussion portion of this study, the expanded IASLC criteria attempts to better account for resections with negative margin but high recurrence risk.⁷ This would appear to emphasize the biology of the disease, which must be accounted for during all stages of treatment. Inadequate or complete lack of lymph node sampling will fail to capture cases with more advanced disease, thus leading to inappropriate further management and disease-related outcomes. However, factors outside of the surgeons' control should be noted, such as extracapsular nodal extension and no metastasis to the highest resection mediastinal lymph node.

Quality measures are an attempt to capture intraoperative performance but are reliant on ideals or 'textbook' definitions. Such standards may inadequately reflect the realities of the individual patients a surgeon encounters. Surgeon quality, when defined by measures that do not account for expected patient variation, should be regarded with some amount of skepticism.

Ray and colleagues should be applauded for undertaking an important study evaluating surgeon quality for lung cancer resection. This study demonstrates that surgeon quality is associated with improved long-term survival. These surgeon-related factors can be intervened upon relatively easily once identified and could contribute to an improvement in long-term survival in this population. The most suitable surgical resection affords the best chance at long-term survival. In the end, a surgeon's understanding of the tenets of oncologic resection and ability to make the appropriate choices pre- and intraoperatively will continue to provide the best outcomes. While each surgeon is accountable for their decisions, a system for periodic evaluation could help identify those who deviate from recommended guidelines and plan for remediation.

DISCLOSURES Catherine G. Pratt and Robert M. Van Haren declare no conflicts of interest.

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