



VATS lobectomy for early lung cancer: long-term outcomes

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Historically, the mainstay of treatment for early-stage lung cancer has been anatomic resection via thoracotomy. Over the last two decades, there has been increasing adoption of video-assisted thoracoscopic surgery (VATS) techniques in this group of patients. VATS resection has been shown to reduce perioperative morbidity and hospital length of stay in multiple series (1-8). Perioperative mortality has also been shown to be lower or equivalent (1-7). While data is limited, several small studies have demonstrated similar survival and recurrence rates with VATS compared to open resection for early-stage lung cancer (9-11).

While the short-term benefits of VATS have been thoroughly described, the oncologic efficacy of VATS resection has been questioned since this technique was first implemented. Recent studies indicating increased nodal upstaging in open versus VATS lobectomy (12,13) have added new concern to this ongoing debate. However, this remains an issue of contention as prior reports demonstrated similar outcomes with regards to lymph node staging in VATS and open resection (14,15). Despite the increasing use of VATS resection for lung cancer and the ongoing debate about oncologic outcome, long-term data on survival are quite limited. In their recent analysis, Yang *et al.* sought to evaluate the long-term survival following VATS or open lobectomy in early-stage lung cancer (16). Using the National Cancer Database (NCDB) to evaluate the outcomes in over 7,000 lobectomies, the authors found that VATS compared to open lobectomy was associated with shorter length of stay and equivalent long-term survival.

Yang *et al.* compared the outcomes of 5,566 open and 1,548 VATS lobectomies for clinical stage T1-2, N0, M0 non-small cell lung cancer (NSCLC). The data were obtained from the NCDB for the year 2010, reflecting current trends in practice and allowing enough time for accrual of survival data. Using the NCDB allowed the authors to study a large and representative population given that the database captures approximately 70% of cancer care in the United States (17). The analysis was further strengthened by a propensity matched analysis of 1,464 open and VATS cases each. In the full and propensity matched analyses, overall 5-year survival in both groups was approximately 65%. There was a small survival advantage in the VATS group that disappeared in the propensity matched and multivariate survival analyses, indicating the likely contribution of confounding variables. The 30-day readmission and 30- and 90-day mortality rates were similar between the groups. As expected, the hospital length of stay was shorter in the VATS group. There were no differences in margin status or nodal upstaging (N1 or N2) between the VATS and open techniques.

While the study by Yang *et al.* is unique in its size and long-term data, it does have several limitations. Because of the retrospective design, unaccounted for selection bias and confounders are likely issues. The authors did take steps to mitigate these effects by performing multivariate and propensity matched analyses. However, it is impossible to control for all factors that led to patients being stratified into VATS or open approaches. One noteworthy difference

between the groups is that VATS was much more likely in academic centers. Surgeons in these settings were presumably more likely to be specialized general thoracic surgeons working in hospitals with special expertise in thoracic surgery. Another potential confounder is preoperative staging, which is not available in the NCDB. If the invasive mediastinal staging rate differed between the VATS and open groups, significant selection bias could have gone unrecognized. The NCDB also lacks data on recurrence patterns or disease-specific survival, which would have been valuable additions to the data on overall survival. The conversion rate of 21.4% is higher than one would expect from previously published series, which ranged from 0–16% (18). Because of the intention to treat design of the statistical analysis, the relatively high conversion rate dilutes the ability to observe the effects of differences in technique. The AJCC 7th edition clinical stage T1-2 patients included in the study encompass tumor sizes up to 7 cm. This makes for a quite heterogeneous group of patients. Given the large number of patients available in the database, more granular stratification of preoperative staging would have been interesting. Robotic operations were excluded in the analysis. While it is clear that the authors sought to compare VATS and open techniques as directly as possible, it would have been valuable to see the outcomes in the robotic group since this is becoming a more widely adopted technique for lung cancer resection.

In their recently published study, Yang *et al.* demonstrate that VATS lobectomy for early-stage NSCLC is associated with shorter hospital stay and similar short- and long-term outcomes when compared to thoracotomy. While the study does suffer from the typical limitations of retrospective database analyses, it provides very valuable evidence that VATS lobectomy is associated with similar overall survival when compared to the historical gold-standard open technique. The overall survival combined with comparable margin status and lymph node upstaging rate are compelling evidence that VATS lobectomy is an adequate oncologic operation in this patient population. As discussed, the short-term benefits of VATS compared to open lobectomy have been thoroughly documented and are further confirmed in this study. Despite these benefits, the rate of minimally-invasive lobectomy for early-stage lung cancer remains surprisingly low. The study by Yang *et al.* provides further support for the concept that morbidity can be minimized without sacrificing oncologic outcome by utilizing VATS techniques in early-stage lung cancer.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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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