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Esophagectomies for Malignancy Among General and Thoracic Surgeons: A Propensity Score Matched National Surgical Quality Improvement Program Analysis Stratified by Surgical Approach

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Abstract

Previous studies of esophagectomy outcomes by surgical specialty do not address malignancy or surgical approach. We sought to evaluate these cases using a national database. The National Surgical Quality Improvement Program (NSQIP)–targeted esophagectomy data set was queried for esophagectomies for malignancy and grouped by surgeon specialty: thoracic surgery (TS) or general surgery (GS). 1:1 propensity score matching was performed. Associations of surgical specialty with outcomes of interest (30-day mortality, anastomotic leak, Clavien-Dindo grade ≥ 3, and positive margin rate) were assessed overall and in surgical approach subsets. 1463 patients met inclusion criteria (512 GS and 951 TS). Propensity score matching yielded matched groups of 512, with similar demographics, preoperative stage, and neoadjuvant therapy rates. All outcomes of interest were similar between TS and GS groups, both overall and when stratified by surgical approach. Esophagectomy for malignancy has a similar perioperative safety profile and positive margin rate among general and thoracic surgeons, regardless of surgical approach.

Keywords

esophagus/foregut, gastrointestinal, general surgery, minimally invasive surgery, thoracic surgery

Key Take-Aways

- General surgeons performing esophagectomies had similar short-term perioperative outcomes as thoracic surgeons.
- Outcomes were similar whether performed with open or minimally invasive approaches.

Esophagectomies are increasingly being performed by thoracic surgery (TS) specialists, though general surgeons and general surgical oncologists continue to perform a significant number as well.[1–4] The debate as to whether surgeon specialty affects outcomes is ongoing, as training paradigms continue to diverge between general surgery (GS) and TS. Previous studies of esophagectomy outcomes by surgical specialty have focused on major morbidity and mortality using nationally collected data.[1–4] Differences in outcomes have not been consistently demonstrated between general and thoracic surgeons. However, these studies have not accounted for outcomes by surgical approach. Furthermore, outcomes specific to esophagectomy, such as anastomotic leak, and outcomes specific to malignancy, such as surgical margins, are unstudied in the context of specialty training. We aimed to better characterize the impact of surgeon specialty and surgical approach on perioperative outcomes of esophagectomy performed for malignancy and hypothesized that overall outcomes would be similar between general and thoracic surgeons, regardless of approach. To test this hypothesis, we employed the American College of Surgeons National Surgical Quality Improvement Program (NSQIP)–targeted esophagectomy data set.

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The NSQIP esophagectomy–targeted data set was queried for adult (age 18 years old and above) patients who underwent esophagectomy (Current Procedural Terminology codes: 43117, 43118, 43121, 43122, 43286, 43287, and 43288) for malignant pathology, from January 1, 2016 through December 31, 2017. Exclusion criteria included surgery performed by specialties other than GS and TS (n = 8) and missing data regarding matching and analyzed variables (n = 6) (Figure 1). Variables analyzed included demographic, clinicopathologic, intraoperative, and postoperative variables. Demographic and clinicopathologic variables included age, body mass index, sex, race, American Society of Anesthesiologists class, previous chemotherapy, previous radiation, clinical tumor stage, and clinical nodal stage. Intraoperative variables included surgical approach and operative time. Postoperative variables included Clavien-Dindo grade, anastomotic leak, positive pathologic margins, mortality, surgical site infection, pneumonia, need for reintubation, pulmonary embolism, renal insufficiency or failure, urinary tract infection, cerebrovascular accident, cardiac arrest, myocardial infarction, bleeding requiring transfusion, deep venous thrombosis, sepsis, and septic shock. Clavien-Dindo grade was calculated using a combination of these variables. Surgical approach was defined by the starting approach, open or MIS, and thus MIS cases converted to open were retained in the MIS group.

Patients were first stratified based on surgical specialty, GS or TS. Propensity score matching was then performed in an optimal matching algorithm in a 1:1 ratio. An absolute standardized difference of $\leq .1$ was considered an appropriate covariate balance between the groups. Propensity score matching was performed based on age, body mass index, race, American Society of Anesthesiologists class ≥ 3, and surgical approach. Outcomes of interest were anastomotic leak, Clavien-Dindo grade ≥ 3, positive margins, and mortality. Univariate logistic regression models were created to compare the GS and TS matched groups. A subgroup analysis of patients by surgical approach was performed with the same statistical method. Associations of variables with the outcomes of interest were expressed as adjusted odds ratios (AOR) with 95% CIs, along with *P*-values. Significance was established at $P < .05$. All statistical analyses were performed using R version 3.6.1 (R Core Team, Vienna, Austria).

A total of 1463 patients met inclusion criteria. Of these, 512 (35.0%) had surgery performed by a general surgeon (GS group) and 951 (65.0%) had surgery performed by a thoracic surgeon (TS group). In the GS group, 177 (34.6%) cases were open and 335 (65.4%) were MIS. In the TS group, 493 (51.8%) were open and 458 (48.2%) were MIS. Propensity score matching yielded balanced groups of 512 in each group. Within the matched groups, the size of the GS group was unchanged, while in TS group 169 (33.0%) were open and 343 (67.0%) were MIS. Rates of neoadjuvant chemotherapy, radiation, clinical T stage, and clinical N stage were similar before and after matching. Before matching, thoracic surgeons had higher rates of reoperation (TS: 17.8% vs GS: 12.3%, $P = .008$) and need for transfusion (TS: 11.9% vs GS: 8.0%, $P = .027$), while general surgeons had higher rates of anastomotic leak (TS: 13.0% vs GS: 17.1%, $P = .043$). However, after matching, only rates of reoperation remained significantly different between groups (TS: 18.4% vs GS: 12.3%, $P = .009$). Rates of all remaining intraoperative and postoperative variables did not significantly differ between TS and GS groups before or after matching. By univariate logistic regression, TS (versus GS) did not have significantly different AORs for any of the outcomes of interest. When stratified by surgical approach, TS still did not have any significantly different AORs for the outcomes of interest, either in the open or MIS subsets (Figure 2).

It is evident from these results that, regardless of outcome or approach, general surgeons did not have inferior perioperative esophagectomy outcomes when compared to thoracic surgeons. Previous studies to assess differences in outcomes between general and thoracic surgeons have shown mixed conclusions about the effect of specialty, with significant interactions noted with surgeon and center volume.[1] Other studies have found similar perioperative complication rates for esophagectomies performed for benign indications by general and thoracic surgeons, while also observing that general surgeons continue to perform a large number of esophagectomies.[3,4] Our study confirms these findings in a cohort of cases performed for malignancy, while also demonstrating no differences in perioperative esophagectomy-specific outcomes. One implication of this finding is that patients may have access to a greater number of surgeons qualified to perform esophagectomy with no compromise of outcomes.

Limitations of our study include those of any study that relies on large, multi-institutional databases, including selection and misclassification bias. The nature of the NSQIP database is such that all outcomes are within a 30-day postoperative period; thus, there is no data regarding 60- and 90-day mortality or long-term survival. The esophagectomy-specific data set also does not provide surgeon-specific or center-specific variables, including training background or volume of practice. The general NSQIP database does provide volume data, but is center-specific, and thus we are unable to determine whether general or thoracic surgeons are contributing to the volume of a center and unable to adjust for this variable. It is essential to recognize that our study is not suggesting that all general surgeons (and thoracic surgeons) can perform

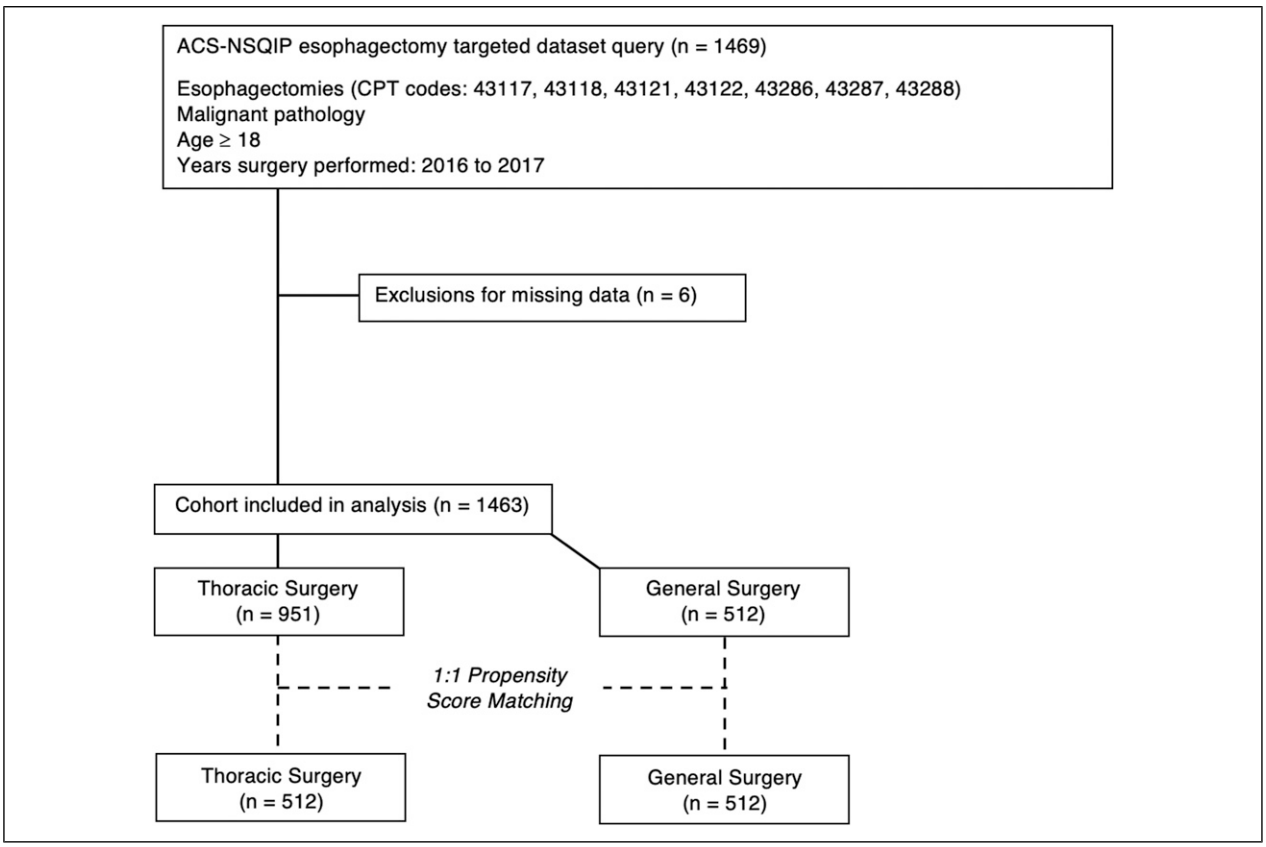

Figure 1. Data sorting process from initial NSQIP esophagectomy–targeted data set query to final cohort and subgroup selection. NSQIP, National Surgical Quality Improvement Program; CPT, current procedural terminology.

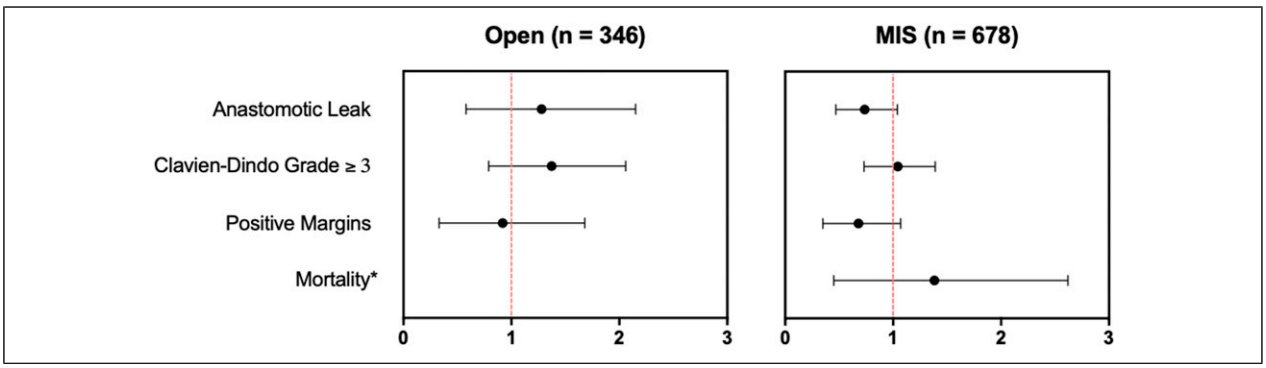

Figure 2. Forest plot of adjusted odds ratios for postoperative outcomes stratified by surgical approach. MIS, minimally invasive surgery.

esophagectomy and achieve satisfactory outcomes. Individual surgeons must possess adequate experience and expertise performing the procedure. Another limitation of our study is that fellowship-trained surgical oncologists are not distinguished from general surgeons in the NSQIP database. It is conceivable that there may be a difference in outcomes between fellowship-trained surgical oncologists and general surgeons that is not reflected in our data. Despite these limitations, the NSQIP-targeted esophagectomy database has many strengths, including a large amount of data, continuous auditing to ensure accuracy, and collection of specific variables to more accurately assess esophagectomy as a procedure.

In this study, surgical specialty did not affect 30-day perioperative outcomes after esophagectomy performed for malignancy. This held true regardless of the surgical approach. Further studies are needed to better characterize these associations.

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