Sex differences in early outcomes after lung cancer resection: Analysis of the Society of Thoracic Surgeons General Thoracic Database

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Objectives: Women with lung cancer have superior long-term survival outcomes compared with men, independent of stage. The cause of this disparity is unknown. For patients undergoing lung cancer resection, these survival differences could be, in part, to relatively better perioperative outcomes for women. This study was undertaken to determine differences in perioperative outcomes after lung cancer surgery on the basis of sex.

Methods: The Society of Thoracic Surgeons’ General Thoracic Database was queried for all patients undergoing resection of lung cancer between 2002 and 2010. Postoperative complications were analyzed with respect to sex. Univariable analysis was performed, followed by multivariable modeling to determine significant risk factors for postoperative morbidity and mortality.

Results: A total of 34,188 patients (16,643 men and 17,545 women) were considered. Univariable analysis demonstrated statistically significant differences in postoperative complications favoring women in all categories of postoperative complications. Women also had lower in-hospital and 30-day mortality (odds ratio, 0.56; 95% confidence interval, 0.44-0.71; \( P < .001 \)). Multivariable analysis demonstrated that several preoperative conditions independently predicted 30-day mortality: male sex, increasing age, lower diffusion capacity, renal insufficiency, preoperative radiation therapy, cancer stage, extent of resection, and thoracotomy as surgical approach. Coronary artery disease was an independent predictor of mortality in women but not in men. Thoracotomy as the surgical approach and preoperative radiation therapy were predictive of mortality for men but not for women. Postoperative prolonged air leak and empyema predicted mortality in men but not in women.

Conclusions: Women have lower postoperative morbidity and mortality after lung cancer surgery. Some risk factors are sex-specific with regard to mortality. Further study is warranted to determine the cause of these differences and to determine their effect on survival. (J Thorac Cardiovasc Surg 2014;148:13-8)
Abbreviations and Acronyms

DLCO = diffusion capacity of carbon monoxide
FEV1 = forced expiratory volume in 1 second
STS = Society of Thoracic Surgeons

identify whether preoperative predictors of surgical mortality differed between men and women.

METHODS

Data Source and Study Cohort

The STS Database Access and Publications Committee and the Institutional Review Board of the Duke University Medical Center approved this study. The STS General Thoracic Database was queried for all patients undergoing resection for lung cancer between 2002 and 2010. Patients aged less than 18 years or undergoing lung resection for non–lung cancer diagnoses were excluded from the analysis.

Variables

Demographic information (age, sex), pulmonary function, preoperative comorbid conditions, extent of resection, surgical approach, and pathologic stage were examined. Comorbid conditions included coronary artery disease, diabetes, history of chemotherapy or radiation, and renal insufficiency. Procedures examined included wedge resection (single or multiple), segmentectomy, lobectomy, bilobectomy, sleeve lobectomy, and pneumonectomy. For purposes of the analysis, procedures were grouped into sublobar (wedge, segmentectomy), lobar (lobectomy, sleeve lobectomy, thoracoscopic lobectomy), and greater-than-lobar resections (bilobectomy, completion pneumonectomy, standard and carinal pneumonectomy). Postoperative events considered were those identified on the Data Collection Form of the STS General Thoracic Surgery Database (http://www.sts.org/quality-research-patient-safety/national-data-base/database-managers/general-thoracic-surgery-database-1).

Statistical Analysis

Fisher exact test was used to determine whether sex was predictive of postoperative complications in the selected population. Association with sex for continuous variables was tested with 2-sample Wilcoxon test and for categoric variables with the Fisher exact test. In addition to 30-day or discharge mortality, individual postoperative events as defined on the database data-collection form were used in the univariable model.

A logistic regression model was used to identify predictors of mortality after surgery, as defined by the STS General Thoracic Database form: immediately postoperatively to discharge, if discharge occurred more than 30 days after procedure, or immediately postoperatively, up to 30 days, if discharged before that time. This model was then applied to the male and female portions of the cohort separately to identify sex-specific risk factors for perioperative mortality. Only patients with complete data were considered for the multivariable model; if at least 1 covariate or outcome was missing, the patient was excluded from the analysis. For the multivariable model, the individual events were grouped into categories for ease of the analysis. The following categories were considered: 30-day or discharge mortality; pulmonary complications (postoperative air leak >5 days, atelectasis requiring bronchoscopy, pneumonia, evidence of adult respiratory distress syndrome, bronchopleural fistula, reintubation, pulmonary embolus or deep venous thrombosis requiring treatment, initial ventilator support >48 hours, tracheostomy, or other pulmonary event); cardiovascular complications (atrial or ventricular arrhythmia, myocardial infarction, other cardiovascular event); gastrointestinal complications; hematologic complications (bleeding requiring reoperation, postoperative blood transfusion); infectious complications (urinary tract infection, empyema, wound infection, sepsis, or other infection requiring treatment); neurologic complications (new central neurologic event, recurrent laryngeal nerve paresis, delirium tremens, or other neurologic event); and miscellaneous complications (new or worsening renal failure, chylothorax, other events requiring medical treatment or other events requiring operating with general anesthesia or unexpected admission to intensive care unit). The analysis was conducted using SAS statistical package version 9.2 (SAS Institute, Cary, NC) and R version 2.8.1 package (http://www.R-project.org).

RESULTS

Between 2002 and 2010, a total of 34,188 patients (17,545 female and 16,643 male) underwent resection for lung cancer in the STS General Thoracic Surgery Database. Women and men differed with regard to baseline characteristics and comorbid conditions (Table 1). Women were younger at the time of surgery with a mean age of 65.8 years, compared with 67.0 years for men (P < .001). Although the mean forced expiratory volume in 1 second (FEV1) was significantly higher for women compared with men (80.4% predicted vs 75.4% predicted, respectively, P < .001), the diffusion capacity of carbon monoxide (DLCO) was significantly lower (69.7% predicted for women vs 72.7% for men, P < .001). With regard to preoperative comorbid conditions, a significantly higher proportion of men had a history of diabetes, coronary artery disease, and renal insufficiency compared with women. In contrast, significantly more women than men had undergone chemotherapy or radiation before surgery. There was a difference in pathologic stage distribution between genders (P < .001), with a higher proportion of women having pathologic stage I disease, relative to higher stages, compared with men. Although the majority of both groups underwent lobectomy for lung cancer resection, women had a relatively higher proportion of sublobar resection and relatively lower proportion of greater-than-lobar resection for surgery, compared with men (P < .001).

Of the 34,188 patients in the study cohort, there were 751 total deaths within 30 days or at discharge (2.2%). However, the mortality rates differed between men and women (Table 2). In female patients, 259 of 17,545 (1.5%) died; in male patients, 492 of 16,643 (3.0%) died (P < .001).

In univariable models of individual postoperative complications, sex was a significant predictor in nearly all events examined. This included each of the individual events within the pulmonary, cardiac, neurologic, hematologic, infectious, and gastrointestinal categories. Female sex was not significant in predicting postoperative chylothorax, either managed medically or requiring surgical intervention (P = .41 and P = .11, respectively). Despite the increased frequency of postoperative complications in men, there was no difference in the proportions of patients who discharged to a site other than home (eg, nursing home).
Within the initial cohort examined, 15,529 patients (7823 female and 7706 male) had no missing data for variables considered in the final multivariable model of discharge or 30-day mortality. Among all patients, significant predictors of mortality included male sex, increasing age, decreasing DLCO, preoperative radiation therapy, renal insufficiency, higher pathologic stage, greater extent of resection, open thoracotomy, and postoperative empyema requiring treatment (Table 3). When the groups were separated by sex, the independent predictors of mortality differed. Age, DLCO, renal insufficiency, and pathologic stage were predictive in the separated groups. However, coronary artery disease was predictive of mortality in women but not in men ($P < .001$). Likewise, preoperative radiation therapy ($P < .001$), thoracotomy as the surgical approach ($P < .001$), postoperative prolonged air leak ($P = .02$), and empyema ($P = .004$) all were predictive of mortality in men but not in women.

**DISCUSSION**

This study demonstrates that women and men undergoing surgery for lung cancer differ with regard to preoperative characteristics and comorbidities. At baseline, women are younger and seem to be healthier than their male counterparts, because a significantly smaller proportion of female patients reported a history of coronary artery disease, renal insufficiency, and diabetes. In addition, there are sex-specific predictors of perioperative mortality for patients undergoing lung cancer resection. To our knowledge, this is the first study to identify such predictors for the female and male patient populations.

More men than women in the study cohort underwent bilobectomy, sleeve resection, or pneumonectomy. There is relatively higher morbidity and mortality associated with these procedures compared with standard lobectomy and sublobar resection. The relatively higher proportion of these procedures in men may contribute to the increased perioperative mortality seen in the study. Also, a relatively higher proportion of female patients had stage I disease. Patients with stage I disease have a better overall prognosis, and those who avoid adjuvant therapy also avoid the toxicities associated with chemotherapy and radiation.

Of note, despite the fact that women had more stage I disease than men, a higher proportion of women had a history of preoperative chemotherapy and radiation. Although the STS General Thoracic Database form delineates both the time course and the indication for preoperative chemotherapy and radiation, we did not separate these factors in the analysis because more women had stage I disease, and thus would be less likely to have undergone preoperative chemotherapy and radiation for their lung cancer. We can only conclude that the women reporting a history of preoperative chemotherapy and radiation received it for a different indication, such as breast cancer.

These data also confirm that women undergoing lung cancer resection have decreased rates of postoperative morbidity and mortality after lung cancer resection. In nearly every category of postoperative complication as defined in the STS Database, women had lower morbidity compared with men. Furthermore, some predictors of perioperative morbidity and mortality differ among men and women.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Female (%) N = 17,545 (51.3)</th>
<th>Male (%) N = 16,643 (48.7)</th>
<th>Total (%)</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y), mean (SD)</td>
<td>65.8 (11.2)</td>
<td>67.0 (10.7)</td>
<td>66.4 (10.9)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>FEV1 predicted, mean (SD)</td>
<td>80.4 (23.1)</td>
<td>75.4 (22.7)</td>
<td>78.0 (23.0)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>DLCO predicted, mean (SD)</td>
<td>69.7 (22.8)</td>
<td>72.7 (24.0)</td>
<td>71.2 (23.4)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>2258 (13.2)</td>
<td>3003 (18.5)</td>
<td>5261 (15.8)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>2271 (15.4)</td>
<td>4786 (32.9)</td>
<td>7057 (24.0)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Preoperative chemotherapy</td>
<td>2174 (14.7)</td>
<td>1986 (13.7)</td>
<td>4160 (14.2)</td>
<td>.013</td>
</tr>
<tr>
<td>Preoperative radiation therapy</td>
<td>1637 (11.1)</td>
<td>1426 (9.8)</td>
<td>3063 (10.5)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Renal insufficiency</td>
<td>262 (1.6)</td>
<td>518 (3.3)</td>
<td>780 (2.4)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Pathologic stage</td>
<td></td>
<td></td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>I</td>
<td>9648 (69.5)</td>
<td>8610 (65.1)</td>
<td>18,258 (67.3)</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>1886 (13.6)</td>
<td>2264 (17.1)</td>
<td>4150 (15.3)</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>1893 (13.6)</td>
<td>1885 (14.2)</td>
<td>3778 (13.9)</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>454 (3.3)</td>
<td>475 (3.6)</td>
<td>929 (3.4)</td>
<td></td>
</tr>
<tr>
<td>Extent of resection</td>
<td></td>
<td></td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Sublobar</td>
<td>3713 (21.2)</td>
<td>3226 (19.4)</td>
<td>6939 (20.3)</td>
<td></td>
</tr>
<tr>
<td>Lobar</td>
<td>12,682 (72.3)</td>
<td>11,718 (70.4)</td>
<td>24,400 (71.4)</td>
<td></td>
</tr>
<tr>
<td>&gt;Lobar</td>
<td>1150 (6.6)</td>
<td>1699 (10.2)</td>
<td>2849 (8.3)</td>
<td></td>
</tr>
<tr>
<td>Surgical approach</td>
<td></td>
<td></td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Open</td>
<td>11,309 (66.2)</td>
<td>11,622 (72.0)</td>
<td>22,931 (69.0)</td>
<td></td>
</tr>
<tr>
<td>VATS</td>
<td>5772 (33.8)</td>
<td>4517 (28.0)</td>
<td>10,289 (31.0)</td>
<td></td>
</tr>
</tbody>
</table>

DLCO, Diffusion capacity of carbon monoxide; FEV1, forced expiratory volume in 1 second; SD, standard deviation; VATS, video-assisted thoracic surgery.
In general, our results are consistent with several other studies of patients undergoing surgery for lung cancer. In a study of patients undergoing lobectomy for lung cancer in the STS Database, Wright and colleagues\textsuperscript{11} demonstrated that male sex was an independent predictor of prolonged length of stay after surgery. Rueth and colleagues,\textsuperscript{10} in an analysis of 4171 patients from the national Surveillance Epidemiology and End Results database, also reported that male sex was an independent predictor of postoperative pulmonary and cardiac complications. However, in contrast to the findings reported by Rueth and colleagues, we found that male sex was also predictive of noncardiopulmonary complications. Some possible explanations for this could be the fact that this study included patients with stage II, III, and IV disease, or that the classification of noncardiopulmonary complications included more variables.

Having coronary artery disease was predictive of surgical mortality in women but not in men. This may reflect differences in the pathophysiology, disease spectrum, clinical presentation, and management of coronary artery disease in women.\textsuperscript{12} In addition to these differences, it has been shown that the medical management and evaluation of women with cardiovascular disease differ from that of men.\textsuperscript{13,14} As a whole, women are referred for cardiovascular diagnostic tests less often than men, which may contribute to an underappreciation of disease extent at the time of surgery.\textsuperscript{15} In addition, women with known cardiovascular disease treated with aspirin prophylaxis derive less protection against myocardial infarction than men.\textsuperscript{16} It is also possible that practice patterns for thoracic surgeons with regard to perioperative aspirin and beta-blockade differ among women and men undergoing lung resection; this has yet to be studied. In light of these findings, it is important for the thoracic surgeon to optimize medical management for all patients with known coronary artery disease in the perioperative period to decrease the risk of mortality. Current specialty guidelines, such as those published by the American College of Cardiology, can be helpful in this setting.\textsuperscript{17}

For men but not women, thoracotomy as the surgical approach and postoperative complications of prolonged air leak and empyema were predictive of mortality. These sex-based differences may be due to immunologic differences between men and women in response to surgery and physiologic stress. In studies of sepsis, women aged more than 50 years had significantly lower hospital mortality than their male counterparts.\textsuperscript{18} It has been postulated that these differences can be attributed to

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**TABLE 2. Sex differences in postoperative complications**

<table>
<thead>
<tr>
<th>Postoperative event</th>
<th>Female (%) N = 17,545</th>
<th>Male (%) N = 16,643</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge or 30-d mortality</td>
<td>259 (1.5)</td>
<td>492 (3.0)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Air leak with duration &gt;5 d</td>
<td>1387 (7.9)</td>
<td>1660 (10.0)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Atelectasis requiring bronchoscopy</td>
<td>522 (3.0)</td>
<td>686 (4.1)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>537 (3.1)</td>
<td>800 (4.8)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Evidence of adult respiratory distress syndrome</td>
<td>153 (0.9)</td>
<td>227 (1.4)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Bronchopleural fistula</td>
<td>46 (0.3)</td>
<td>93 (0.6)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Reintubation</td>
<td>512 (2.9)</td>
<td>742 (4.5)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Pulmonary embolus or DVT requiring treatment</td>
<td>129 (0.7)</td>
<td>164 (1.0)</td>
<td>.012</td>
</tr>
<tr>
<td>Initial ventilator support &gt;48 h, tracheostomy, or other pulmonary event</td>
<td>948 (5.4)</td>
<td>1039 (6.2)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Atrial arrhythmia requiring treatment</td>
<td>1571 (9.0)</td>
<td>2287 (13.7)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Ventricular arrhythmia requiring treatment</td>
<td>105 (0.6)</td>
<td>157 (0.9)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Myocardial infarct</td>
<td>44 (0.3)</td>
<td>94 (0.6)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Other cardiovascular event</td>
<td>260 (1.5)</td>
<td>360 (2.2)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Gastrointestinal complications</td>
<td>288 (1.6)</td>
<td>447 (2.7)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Postoperative blood transfusion</td>
<td>965 (5.5)</td>
<td>1127 (6.8)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Bleeding requiring reoperation</td>
<td>109 (0.6)</td>
<td>158 (0.9)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>390 (2.2)</td>
<td>225 (1.4)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Empyema requiring treatment</td>
<td>45 (0.3)</td>
<td>98 (0.6)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Wound infection</td>
<td>59 (0.3)</td>
<td>81 (0.5)</td>
<td>.030</td>
</tr>
<tr>
<td>Sepsis or other infection requiring treatment</td>
<td>163 (0.9)</td>
<td>254 (1.5)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>New central neurologic event</td>
<td>90 (0.5)</td>
<td>112 (0.7)</td>
<td>.045</td>
</tr>
<tr>
<td>Recurrent laryngeal nerve paresis or delirium tremens or other neurologic event</td>
<td>341 (1.9)</td>
<td>494 (3.0)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>New renal failure requiring treatment or worsening renal function (≥2× preoperative value)</td>
<td>171 (1.0)</td>
<td>343 (2.1)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Chylothorax requiring drainage or medical treatment only</td>
<td>64 (0.4)</td>
<td>52 (0.3)</td>
<td>.41</td>
</tr>
<tr>
<td>Chylothorax requiring surgical intervention</td>
<td>40 (0.2)</td>
<td>53 (0.3)</td>
<td>.11</td>
</tr>
<tr>
<td>Other events requiring medical treatment or other events requiring OR with general anesthesia or unexpected admission to ICU</td>
<td>758 (4.3)</td>
<td>1021 (6.1)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

*DVT, Deep vein thrombosis; ICU, intensive care unit; OR, operating room.*
increased levels of sex hormones and anti-inflammatory mediators. Furthermore, it has been shown that patients undergoing thoracoscopic lobectomy have decreased immune suppression after surgery than those undergoing thoracotomy. Because women have relatively less immune suppression after surgery compared with men, it is possible that the immunologic benefits of video-assisted thoracoscopic surgery may be less significant for women. Also, because immunosuppression is associated with prolonged air leaks after thoracic surgery, it is conceivable that women have relatively decreased immune suppression after lung resection compared to men, and thus may benefit in terms of fewer postoperative air leaks. This certainly represents an area of possible future study.

In this study, pathologic stage, resection greater than lobectomy, and postoperative empyema also were independent predictors of surgical mortality. This is consistent with other authors’ findings. However, in the current study, decreasing FEV1 did not predict mortality. This is in contrast to other studies, in which FEV1 has been associated with surgical mortality. Table 3. Predictors of mortality after lung cancer resection

<table>
<thead>
<tr>
<th>Variable</th>
<th>All patients</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female sex</td>
<td>0.56 (0.44-0.71)</td>
<td>&lt;.001</td>
<td>1.04 (1.02-1.06)</td>
</tr>
<tr>
<td>Age</td>
<td>1.06 (1.04-1.07)</td>
<td>&lt;.001</td>
<td>1.09 (1.05-2.56)</td>
</tr>
<tr>
<td>DLCO</td>
<td>0.98 (0.97-0.99)</td>
<td>&lt;.001</td>
<td>0.97 (0.96-0.98)</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>1.23 (0.97-1.56)</td>
<td>&lt;.001</td>
<td>1.64 (1.05-2.56)</td>
</tr>
<tr>
<td>Preoperative radiation therapy</td>
<td>1.60 (1.05-2.46)</td>
<td>&lt;.001</td>
<td>1.24 (0.64-2.42)</td>
</tr>
<tr>
<td>Renal insufficiency</td>
<td>3.13 (2.09-4.68)</td>
<td>&lt;.001</td>
<td>4.68 (2.19-10.04)</td>
</tr>
<tr>
<td>Pathologic stage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>II</td>
<td>1.05 (0.76-1.44)</td>
<td>&lt;.001</td>
<td>0.79 (0.42-1.49)</td>
</tr>
<tr>
<td>III</td>
<td>1.65 (1.24-2.21)</td>
<td>&lt;.001</td>
<td>1.69 (1.04-2.74)</td>
</tr>
<tr>
<td>IV</td>
<td>2.43 (1.46-4.05)</td>
<td>&lt;.001</td>
<td>2.19 (0.91-5.25)</td>
</tr>
<tr>
<td>Extent of resection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sublobar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lobar</td>
<td>1.53 (1.07-2.19)</td>
<td>&lt;.001</td>
<td>1.41 (0.80-2.48)</td>
</tr>
<tr>
<td>&gt;Lobar</td>
<td>4.51 (2.95-6.89)</td>
<td>&lt;.001</td>
<td>4.44 (2.18-9.05)</td>
</tr>
<tr>
<td>Approach</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thoracotomy</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>VATS</td>
<td>0.69 (0.52-0.91)</td>
<td>&lt;.001</td>
<td>0.90 (0.58-1.41)</td>
</tr>
<tr>
<td>Postoperative air leak &gt;5 d</td>
<td>1.33 (0.96-1.84)</td>
<td>&lt;.001</td>
<td>0.88 (0.45-1.71)</td>
</tr>
<tr>
<td>Postoperative empyema</td>
<td>3.99 (1.88-8.45)</td>
<td>&lt;.001</td>
<td>4.38 (0.55-34.72)</td>
</tr>
</tbody>
</table>

CI, Confidence interval; DLCO, diffusion capacity of carbon monoxide; OR, odds ratio; VATS, video-assisted thoracic surgery.

CONCLUSIONS

It has been demonstrated that women undergoing lung cancer resection have improved long-term survival relative to men. There are several points along the lung cancer treatment continuum that can affect outcomes and survival, including surgery and its postoperative complications. Patients with increased morbidity from surgery and prolonged hospital stays may take longer to fully recover from the operation. As such, these patients may be less likely to begin adjuvant therapy in a timely manner, and therefore may not receive the optimum benefit from this treatment. As we, and others, have demonstrated that female sex is predictive of superior postoperative outcomes, it is possible that these differences contribute to the sex-related differences in long-term survival. Additional longitudinal studies of these sex differences, with particular emphasis on completion and adherence to adjuvant therapy regimens, would be helpful in this regard. Also, studies of STS Database is a voluntary database of thoracic surgeons and may not accurately reflect procedures performed by nonparticipants or noncardiothoracic surgeons.

Study Limitations

Our study is potentially limited by missing data in the STS General Thoracic Database. The initial study cohort had 34,188 patients; however, because of missing data, only 15,529 were included in the multivariable model. Although the data remain robust, including the other 18,659 patients from the initial analysis might strengthen the findings and conclusions in this study. In addition,
tumor biology and response to therapy, as related to the respective female and male physiologic states, might help to provide answers to these important questions.

References