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Variations in Surgeon Treatment Recommendations for Lobectomy in Early-Stage Non-Small-Cell Lung Cancer by Patient Age and Comorbidity

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Abstract

Background—Prior research suggests that older patients are less likely to undergo resection of early-stage non-small-cell lung carcinomas (NSCLCs). We surveyed surgeons to understand how their recommendations for lobectomy were influenced by age, the presence and severity of smoking-related lung disease, or by characteristics of the surgeons and their practices.

Methods—We surveyed surgeons caring for NSCLC patients regarding whether they would recommend lobectomy for hypothetical patients with early-stage NSCLC who varied by age (55 vs. 80 years) and comorbid illness (none, moderate, severe chronic obstructive pulmonary disease [COPD]). Ordinal logistic regression was used to identify the importance of patient, surgeon, and practice characteristics on surgery recommendations.

Results—Surgeons recommended lobectomy for nearly all patients who were 55 years old with no comorbidity (adjusted proportion 98.6%), 55 years old with moderate COPD (adjusted proportion 97.8%), or 80 years old with no comorbidity (adjusted proportion 98.1%). Fewer recommended lobectomy for 80-year-old patients with moderate COPD (adjusted proportion 82.3%), and far fewer recommended lobectomy for severe COPD, irrespective of age (adjusted rate 18.7% for the 55-year-old patient and 6.1% for the 80-year-old patient) ($P < 0.002$). Surgeons who enroll patients onto clinical trials ($P = 0.03$) were more likely than others to recommend lobectomy, but no other surgeon characteristic predicted recommendations.

Conclusions—Lower rates of lobectomy among older patients do not seem to be explained by age-related biases among surgeons for otherwise healthy patients.

Lung cancer is the leading cause of cancer mortality in men and women in the United States.^{1,2} Although most patients with lung cancer have advanced disease at diagnosis, 16% have early-stage (stage I or II) cancers that have the potential for cure with appropriate treatment.¹ Strong retrospective evidence suggest that surgery for early-stage non-small-cell lung carcinomas (NSCLC) provides patients with the best chance for cure.³ The recommended surgical resection for early-stage NSCLC is lobectomy or lung-sparing anatomic resection (sleeve lobectomy) combined with mediastinal lymph node dissection.^{3–7} For patients with stage I disease, 5-year survival after lobectomy is approximately 45–65%, compared with 6% for untreated patients.^{8,9} Although surgery offers the best chance for cure, not all patients with stage I–II disease are willing or able to undergo surgical resection, and for such patients, radiotherapy can be provided with curative intent.^{3,4,10}

Lung cancer is a disease of the elderly, with the peak incidence between the ages of 75 and 79 years.² The relationship between increasing age and major operative complications or postoperative mortality is uncertain.¹¹ Some studies have shown that age is a risk factor for death after lung cancer resection, but other studies have failed to demonstrate a causal relationship between age and operative complications or death.^{12–15} Despite this uncertainty, age itself is not a contraindication for surgery, and many studies have demonstrated that resection of early-stage NSCLC can be highly effective for elderly patients.^{11,16–20} Recent reports have demonstrated 5-year survival rates for octogenarians after lung resection ranging from 56.9 to 82%.^{18,19,21}

Nevertheless, several studies have reported disparities by age in receipt of lung cancer surgery.^{12,17,22,23} For example, an analysis of the Surveillance, Epidemiology, and End Results (SEER) database found that for stage I and II NSCLC, curative surgery was performed in only 70% of patients who were ≥75 years of age compared to 92% of those <65 years of age.¹⁷ A study from the United Kingdom demonstrated far lower rates of resection for patients aged >75 than for patients aged <65, even in the group of patients who had an excellent performance status and no chronic obstructive pulmonary disease (COPD).²³

It remains unclear whether older patients are not having surgery because surgeons are reluctant to operate on older patients (even when healthy) or because older patients have more severe lung disease or other comorbid illnesses that put them at higher risk of complications. We surveyed surgeons who cared for patients with NSCLC to examine: (1) to what extent surgeons' recommendations for lobectomy for NSCLC vary by patients' age; (2) whether the presence of COPD influences recommendations differently for younger versus older patients; and (3) whether surgeon or practice characteristics account for variations in surgeons' reports of recommendations for lobectomy.

METHODS

Study Design

Data for this study were collected as part of a large national study of processes and outcomes of care for patients with lung or colorectal cancer undertaken by the Cancer Care Outcomes Research and Surveillance (CanCORS) Consortium.²⁴ The CanCORS study is examining care delivered to a population- and health system-based cohort of more than 10,000 patients diagnosed with lung or colorectal cancer during 2003–2005 who were living in Northern California, Los Angeles County, North Carolina, Iowa, or Alabama, or who received their care in one of five large health maintenance organizations or at one of 15 sites

in the Veterans Health Administration. Data have been collected from patients (or surrogates), medical records, patients' physicians, and informal caregivers of some patients. The study was approved by the human subjects committees at all participating institution. This analysis uses only data from the physician survey.

Study Population

We surveyed surgeons named by patients as providing surgery or discussing surgery for patients who did not have an operation. We restricted the sample to the 254 general surgeons and thoracic surgeons who completed the survey and cared for at least one patient with lung cancer during the past year. We excluded 21 Veterans Health Administration physicians who were surgical residents. We also excluded seven surgeons who were missing three or more of the six items about surgical recommendations. The final cohort consisted of 226 surgeons. The participation rate was 62.5%.

Survey Instrument

To understand the influence of patient age on surgeons' recommendations for surgery and whether this is influenced by the presence and severity of smoking-related lung disease (COPD), we asked each surgeon to respond to the following scenario: "How likely are you to recommend lobectomy for a 2-cm right upper lobe lesion for the following patients? The lung mass was noted on chest X-ray and computed tomographic scan and diagnosed in radiology by core biopsy as NSCLC. You are satisfied that complete staging evaluation demonstrates no clinical or radiographic evidence for involved lymph nodes or metastatic disease." The patients included a 55-year-old man who has: (1) no other medical problems; (2) moderate COPD; (3) severe COPD. The same questions were repeated for an 80-year-old man. Surgeons responded using a 4-point Likert scale (1 = very unlikely, 2 = somewhat unlikely, 3 = somewhat likely, 4 = very likely). Surgeons also provided information about personal and practice characteristics.

Survey Administration

We mailed self-administered questionnaires to physicians; nonresponding physicians were mailed another questionnaire after 3 weeks. After another 3 weeks, physicians' offices were phoned to encourage completion of the survey, and additional questionnaires were sent on request. All physicians were given the option of completing the survey via a secure Internet site, and 12% of physicians chose this option.

Statistical Analysis

Item nonresponse was <2 to 3% for most variables. We used multiple imputation to impute missing data for missing items.^{25,26}

We described recommendations for lobectomy and then dichotomized each response as somewhat/very likely to recommend versus somewhat/very unlikely to recommend. We then summed the number of scenarios for which surgeons recommended lobectomy. We used the Wilcoxon rank sum test or the Kruskal-Wallis test to assess whether surgeon or practice characteristics were associated with number of recommendations. Specifically, we assessed associations with self-reported physician specialty, physician age, sex, race and ethnicity, board certification, United States medical graduate, teaching involvement, practice type, practice site, proportion of patients in managed care, geographic site, the number of lung cancer patients cared for in the last month, whether their practice is part of the Community Clinical Oncology Program, whether they practice at a National Cancer Institute-designated cancer center, attendance at tumor board meetings, and whether they enroll patients onto clinical trials. Variables were categorized as in Table 1.

We used logistic regression to identify surgeon and practice characteristics associated with recommending lobectomy on the basis of the summary recommendation score. We included all surgeon and practice variables with $P < 0.20$ on bivariate testing. Because we were primarily interested in the effects of both patient age and patient comorbidity on recommendations, we included a term for the interactions of these variables in the model. We calculated adjusted rates of recommending lobectomy for each patient scenario and for each of the physician characteristics by using a standardized regression approach.

In sensitivity analyses, we repeated each model using ordinal logistic regression. We also repeated analyses specifically examining the two scenarios with the most variability (the 55-year-old patient with severe COPD and the 80-year-old patient with moderate COPD). All tests of statistical significance were two sided. We conducted analyses using SAS statistical software, version 8.2 (SAS Institute, Cary, NC).

RESULTS

Most surgeons (93%) were men, and approximately half (48%) were engaged in teaching at least 1 day per month (Table 1). Most surgeons saw more than four lung cancer patients per month, on average.

Surgeons' recommendation for lobectomy varied substantially by severity of COPD (Fig. 1), with much less variability by age. Nearly all surgeons were very likely to recommend lobectomy for a healthy 55-year-old and for a healthy 80-year-old. Fewer surgeons were very likely to recommend lobectomy for a 55-year-old with moderate COPD, although nearly all surgeons were very or somewhat likely to recommend lobectomy. For the 80-year-old patient with moderate COPD, nearly 20% of surgeons were unlikely to recommend lobectomy. Most surgeons were very or somewhat unlikely to recommend lobectomy for a patient with severe COPD, particularly if that patient was also 80 years old. In the scenario with the most variability, the 55-year-old with severe COPD, 53.5% were very unlikely, 22.9% were somewhat unlikely, 16.9% somewhat likely, and 2.2% very likely to recommend lobectomy.

After dichotomizing responses into very/somewhat likely versus very/somewhat unlikely to recommend, the mean number (of the six scenarios) for which surgeons were likely to recommend surgery was 3.6 (standard deviation 0.9). The distribution ranged from 0 to 6, with a median of 4. In unadjusted analyses, U.S. medical graduates were more likely than others to recommend lobectomy. Surgeons who saw 0–4 patients per year made 3.8 recommendations for lobectomy, whereas surgeons who saw >11 patients made 4.3 recommendations for lobectomy ($P = 0.02$).

In adjusted analyses, patient age and level of comorbidity were the strongest predictors of recommendation for lobectomy (Table 2). Controlling for surgeon and practice characteristics, patient age, and comorbidity remained the strongest predictors of recommendations for surgery. Nearly all surgeons recommended lobectomy for healthy patients whether they were 55 years old (adjusted proportion 98.6%) or 80 years old (adjusted proportion 98.1%), and for a 55-year-old with moderate COPD (adjusted proportion 97.8%). Fewer recommended lobectomy for an 80-year-old with moderate COPD (adjusted proportion 82.3%). Few surgeons recommended lobectomy for a 55-year-old with severe COPD (adjusted proportion 18.7%), and even fewer for an 80-year-old with severe COPD (adjusted rate 6.1%).

Surgeon and practice characteristics explained very little of the variation in recommendations. Surgeons who enroll patients onto clinical trials ($P = 0.03$) were more

likely than their counterparts to recommend surgery, but no other surgeon characteristics were associated with recommendations.

We repeated analyses with the recommendations coded as ordinal variables (1–4), and results were similar (data not shown). We also repeated analyses specifically examining the two scenarios with the most variability (the 55-year-old patient with severe COPD and the 80-year-old patient with moderate COPD), and results were similar (data not shown).

DISCUSSION

We examined recommendations for lobectomy for early-stage NSCLC in a population-based survey of surgeons and found that nearly all surgeons were consistent in their recommendations for guideline-based therapy for healthy patients, regardless of age.^{3,4} We also found that surgeons were less likely to recommend lobectomy for patients who had increasing severity of COPD, and that recommendations for lobectomy among patients with COPD varied by patient age.

Even though older patients with early-stage NSCLC can be cured of their disease with surgical resection, prior research has demonstrated that many patients who are potentially eligible for lung cancer resection do not receive it, and that rates of surgery decrease with increasing patient age.^{12,17,22,23} Because comorbidity increases with increasing age, variations in surgical resection rates may relate more to the presence of comorbidities in older patients than to age itself. In this study, we tried to disentangle the effects of age and comorbidity on surgeon recommendations for lobectomy in patients with early-stage NSCLC. Ninety-eight percent of surgeons in our study would recommend lobectomy to an 80-year-old patient without other medical problems. Consistently high recommendations for lobectomy in older adults may be even more common now than in years past as new, minimally invasive techniques such as video-assisted thoracic surgical lobectomy have been shown to decrease pain and length of hospitalization and to improve discharge independence in frail and older populations.^{27,28} Our findings suggest that surgeons' concerns about operating on older healthy individuals are unlikely to explain current age-related disparities in lung cancer resection.

Surgeons in our study were less likely to recommend lobectomy for patients as the severity of COPD increased. This finding may reflect a concern over greater operative or postoperative complications among patients with compromised lung function. Because lung cancer resection places patients at increased risk of pulmonary complications postoperatively, attention to predicting and preventing postoperative respiratory complications has been an important area of research. COPD may place patients at increased risk for postoperative respiratory complications, but it remains difficult to determine preoperatively a patient's physiological limits for surgery.¹⁶ Before lung resection, patients routinely undergo functional respiratory studies, including spirometry, diffusing capacity, arterial blood gases, and regional pulmonary ventilation and perfusion studies.^{16,29} However, traditional methods of measuring pulmonary function have not reliably predicted postoperative events, and the precise impact of COPD on postoperative outcomes in both older and younger patients remains unclear.³⁰

We found that patient age may play a role in surgeons' recommendations for lobectomy in patients who have COPD. Surgeon less often recommended lobectomy for older patients than for younger patients with moderate COPD and for patients with severe COPD. These age-related variations in surgeon recommendation may, in part, explain some of the age-related disparities previously described in the literature. They also suggest that patients with COPD may or may not be offered lobectomy depending on the surgeon that they see.

There are a few possible explanations for why surgeons may be less willing to recommend lobectomy for older patients with COPD than for younger patients with COPD. Even though there are conflicting data on whether age is an independent risk factor for operative complications or postoperative death, surgeons may believe that older patients with COPD are more likely to experience operative and postoperative morbidity and mortality than younger patients with COPD.¹¹ Surgeons may also recommend lobectomy less often to older patients with COPD than younger patients with COPD because they may be more likely to offer older patients limited surgical resections instead. A recent analysis of the SEER database demonstrated that elderly patients were more likely than younger patients to undergo limited resections (wedge resections and segmentectomies) (17% in elderly patients vs. 8% in young patients).¹⁷ This study demonstrated a survival advantage for lobectomy over limited surgical resections in young patients but not in patients over 71 years of age.¹⁷ Although the findings from this study need confirmation in a prospective, randomized trial, it is possible that surgeons are using more limited surgical techniques in older patients based on these data and/or their personal experience.

We observed some variation in treatment recommendations for patients who were young with severe COPD or older with moderate COPD. Overall, surgeon and practice characteristics explained little of the variation we observed. Surgeons who participate in clinical trials were somewhat more likely to recommend surgery; they may practice at institutions with better intraoperative support, such as greater anesthesiology staffing or more postoperative support for patients with complications, such as may be available in intensivist-led intensive care units. No other surgeon or practice characteristics were associated with recommendations.

Our study's strengths include a relatively large, representative sample of surgeons from geographically diverse areas. Also, we had rich data on surgeon and practice characteristics. Our findings, however, should be interpreted in light of several limitations. First, we used a vignette to assess surgeons' recommendations for treatment. Some contest the value of vignettes as a measure of actual practice behavior. Nevertheless, others have found clinical vignettes to be a valid tool for measuring care delivered in clinical practice.³¹ In addition, because we varied the severity of COPD, rather than overall health, in our vignettes, the observed variations in recommendation for lobectomy by age in the patients with COPD may be somewhat confounded by surgeon concern over other comorbidities, leading to underrecommended lobectomy on that basis. Third, the response option categories were necessarily somewhat artificial; however, our findings were robust to analysis using an ordinal scale. Fourth, CanCORS participants were not designed as a random sample from all diagnosed lung cancer patients nationally, and our survey is subject to nonresponse bias, so we cannot be certain that the surgeons in our sample were representative of surgeons caring for lung cancer patients across the United States or in the regions studied. Finally, the lower propensity of older patients to undergo lobectomy for early-stage NSCLC could be due to patient preferences or other barriers, such as negative attitudes toward surgery, that we were unable to assess in this study.

In conclusion, we observed that age alone did not influence surgeons' recommendations for lobectomy in patients with early-stage NSCLC. Surgeons were much less likely to recommend surgery for patients with severe COPD, particularly if the patients were older. Additional research is needed to understand why surgeons vary in their recommendations for lobectomy in patients with COPD and whether elderly patients with COPD are receiving care that maximizes their long-term survival.

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FIG. 1.
Surgeons' likelihood of recommending lobectomy for early-stage non-small-cell lung cancer by patient age and severity of chronic obstructive pulmonary disease

TABLE 1

Number of recommendations by surgeon characteristics among surgeons caring for patients with non-small-cell lung cancer (with variables dichotomized and summed)

Surgeon characteristic	n (%)	Mean no. of the 6 scenarios for which surgery was recommended (SD)	<i>p</i> ^a
Total	226 (100)	4.02 (0.82)	
Specialty			0.16
General surgeon	100 (44)	3.95 (0.76)	
Thoracic surgeon	126 (56)	4.07 (0.86)	
Age (y)			0.34
< 40	28 (12)	4.04 (1.20)	
40–49	67 (30)	4.10 (0.74)	
50–54	44 (19)	4.00 (0.68)	
55–59	39 (17)	4.13 (0.83)	
60+	48 (21)	3.81 (0.73)	
Sex			0.96
Male	211 (93)	4.02 (0.83)	
Female	15 (7)	4.00 (0.53)	
Race/ethnicity			0.31
Non-Hispanic white	180 (80)	4.06 (0.75)	
Asian	31 (14)	3.74 (1.06)	
Other	15 (7)	4.07 (0.96)	
Board certified in specialty			0.79
Yes	204 (90)	4.02 (0.76)	
No	22 (10)	3.95 (1.25)	
U.S. medical graduate			0.03
Yes	204 (90)	4.05 (0.79)	
No	22 (10)	3.73 (1.03)	
Teaching			0.16
None	118 (52)	3.96 (0.71)	
1–5 days per month	31 (14)	3.84 (1.16)	
6 days per month	77 (34)	4.18 (0.79)	
Practice site			0.65
Office	79 (35)	3.97 (0.82)	
Hospital	147 (65)	4.04 (0.82)	
Proportion of patients in managed care			0.97
0–20%	55 (24)	4.05 (0.80)	
21–40%	48 (21)	3.98 (0.93)	
41–70%	53 (23)	4.06 (0.93)	
71–100%	70 (31)	3.99 (0.65)	
Study site			0.34
5 health maintenance organizations	10 (4)	4.10 (0.99)	
8 Northern California counties	62 (27)	4.02 (0.69)	

Surgeon characteristic	<i>n</i> (%)	Mean no. of the 6 scenarios for which surgery was recommended (SD)	<i>p</i> ^a
Los Angeles County	36 (16)	4.19 (0.86)	
State of Alabama	49 (22)	3.92 (0.89)	
State of Iowa	27 (12)	4.26 (0.59)	
State of North Carolina	25 (11)	3.80 (0.91)	
Veterans Health Administration	17 (8)	3.82 (0.95)	
No. of lung cancer patients seen in previous month			0.02
0–4	85 (38)	3.81 (0.85)	
5–6	52 (23)	4.12 (0.76)	
7–10	42 (19)	4.02 (0.75)	
11+	47 (21)	4.28 (0.80)	
Practice part of CCOP			0.21
Yes	85 (38)	4.08 (0.88)	
No	141 (62)	3.98 (0.78)	
Practice at NCI cancer center			0.31
Yes	77 (34)	4.10 (0.98)	
No	149 (66)	3.97 (0.72)	
Attend tumor board meetings			0.85
Weekly	85 (38)	3.99 (0.87)	
Monthly	68 (31)	4.01 (0.92)	
Quarterly or less frequently	73 (32)	4.05 (0.64)	
Enroll patients in clinical trials			< 0.001
Yes	89 (39)	4.26 (0.92)	
No	137 (61)	3.86 (0.70)	

CCOP Community Clinical Oncology Program, NCI National Cancer Institute

^aBased on the Wilcoxon rank sum test for dichotomous variables and the Kruskal-Wallis test for multilevel categorical variables

TABLE 2

Adjusted rates of recommendations for resection of early-stage non-small-cell lung cancer

Surgeon characteristic	Adjusted proportion for whom surgeons recommended resection	<i>P</i> ^a
<i>Overall</i>		
Patient age and comorbidity		0.002
55-year-old, no comorbidity	98.6	
55-year-old, moderate COPD	97.8	
55-year-old, severe COPD	18.7	
80-year-old, no comorbidity	98.1	
80-year-old, moderate COPD	82.3	
80-year-old, severe COPD	6.1	
Specialty		0.47
General surgeon	67.9	
Thoracic surgeon	66.1	
U.S. medical graduate		0.12
Yes	67.4	
No	62.6	
Teaching		0.56
None	67.1	
1–5 days per month	64.0	
6 days per month	67.8	
Study site		0.51
5 health maintenance organizations	67.4	
8 Northern California counties	66.8	
Los Angeles County	69.1	
State of Alabama	66.5	
State of Iowa	70.0	
State of North Carolina	64.1	
Veterans Health Administration	62.8	
Enroll patients in clinical trials		0.03
Yes	70.1	
No	64.9	
No. of lung cancer patients per month		0.40
0–4	65.2	
5–6	68.9	
7–10	68.3	
11+	68.4	

COPD chronic obstructive pulmonary disease

^aLogistic regression was used with generalized estimating equations to control for all other variables in the table. Model included an interaction term for patient age and patient comorbidity as well as all variables with bivariate association of $\geq .20$