Lobectomy versus segmentectomy in patients with T1N2 non–small cell lung cancer: An analysis of the National Cancer Database

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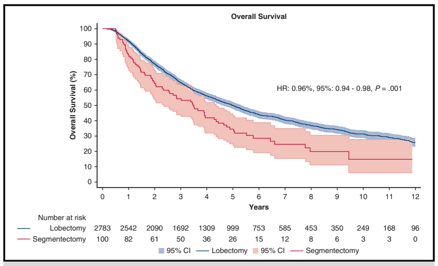
ABSTRACT

Objective: To assess survival outcomes for patients with stage IIIA (T1N2M0) non–small cell lung cancer (NSCLC) using the National Cancer Database (NCDB).

Methods: Patients with T1N2M0 NSCLC undergoing lobectomy or segmentectomy were identified in the NCDB from 2004 to 2019. Patient characteristics were compared using χ^2 and Fisher exact tests. Overall survival was evaluated using the Kaplan-Meier method and the Cox proportional hazard analysis adjusting for type of resection, age, sex, and margin positivity, Charlson comorbidity index, number of lymph nodes examined, number of positive lymph nodes, and tumor size.

Results: In total, 2883 patients with T1N2 NSCLC undergoing segmentectomy or lobectomy were identified. The majority (96.5%) of patients received lobectomy and 100 (3.5%) patients received segmentectomy. Patients undergoing segmentectomy were older ($P = .001$) and had tumors in the lower lobe of the lung ($P = .001$) versus patients undergoing lobectomy. Fewer patients who received segmentectomy underwent radiation ($P = .015$) and neoadjuvant chemotherapy ($P = .041$). Fewer patients undergoing segmentectomy had >10 lymph nodes examined and >5 positive nodes compared with patients receiving lobectomy (both $P < .001$). Although 30-day readmission rates were similar ($P = .27$), 30-day mortality was lower in the segmentectomy cohort ($P = .047$). There was a significantly lower risk of death among patients undergoing lobectomy versus segmentectomy (hazard ratio, 0.96; 95% confidence interval, 0.94-0.98; $P = .001$).

Conclusions: In this NCDB analysis, lobectomy was more commonly performed for T1N2 NSCLC compared with segmentectomy. Lobectomy offered a significant survival advantage over segmentectomy, even when adjusting for risk factors. Thus, these findings suggest that lobectomy may be a superior resection of choice for patients with T1N2 disease. (JTCVS Open 2024;21:304-12)



Overall survival for T1N2 NSCLC lobectomy versus segmentectomy, NCDB 2004-2019.

CENTRAL MESSAGE

Lobectomy offers a survival advantage over segmentectomy for T1N2 NSCLC, even when adjusting for known risk factors. Lobectomy should be the resection of choice for patients with T1N2 disease.

PERSPECTIVE

Sublobar resection is a viable option for patients with T1N0 disease, but whether this can be recommended in T1N2 disease is underexplored. Further, symptomatic compromised pulmonary function is common in patients with resectable NSCLC, and data on surgical approaches may lead to more informative preoperative discussions. This study shows that lobectomy has superior survival outcomes versus segmentectomy.

Lobectomy has been the gold standard treatment for stage I non–small cell lung cancer (NSCLC) since the 1995 trial, which established superior recurrence and lung cancer-specific mortality outcomes for lobectomy compared with sublobar resection (ie, segmentectomy).[1] However, improvements in diagnostic and surgical techniques over recent

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Abbreviations and Acronyms

CI	= confidence interval
HR	= hazard ratio
IO	= immuno-oncology
IQR	= interquartile range
NACT	= neoadjuvant chemotherapy
NCDB	= National Cancer Database
NSCLC	= non–small cell lung cancer

decades have led to a growing body of research on the outcomes of segmentectomy for patients with T1N0 disease.[2]

A 2022 randomized noninferiority controlled trial from Japan showed improved survival outcomes among patients with stage IA NSCLC who underwent sublobar resection compared with those undergoing lobectomy.[3] In 2023, noninferiority of sublobar resection was reported in a multicenter, phase 3 trial using an international cohort.[4] This 2023 study showed that overall survival, 5-year disease-free survival, and 5-year overall survival were similar for patients receiving lobectomy versus sublobar resection, and the predicted forced expiratory volume in 1 second at 6 months after surgery favored patients undergoing segmentectomy.[4] With these randomized trial data, parenchymal preservation has become a promising surgical option in patients with early-stage NSCLC.

Surgical treatment for N2 disease remains challenging. Randomized trial data show limited survival benefit of surgery over radiotherapy for patients with N2 disease.[5,6] Yet, select patients (ie, single station, nonbulky) with N2 disease may nonetheless benefit from surgery after neoadjuvant chemotherapy and should be evaluated by a multidisciplinary team for consideration.[7,8] In fact, in a 2019 study of the National Cancer Database (NCDB), Razi and colleagues[9] found that survival was similar among patients with T1N0 disease who had unsuspected pathologic N1/N2 nodal metastases and received lobectomy or segmentectomy.

As parenchymal preservation for earlier stage NSCLC becomes a viable and potentially superior treatment option in patients with T1N0 disease, whether segmentectomy could be similarly recommended in patients with T1N2 disease is underexplored. In addition, symptomatic compromised pulmonary function is prevalent among patients with resectable lung cancer and therefore any data regarding segmentectomy versus lobectomy in the T1 (<2 cm) N2 population may provide for a more informative preoperative discussion with this patient population. Accordingly, the aim of this study was to assess survival outcomes for patients with stage IIIA (T1N2M0) NSCLC using the NCDB.

METHODS

The institutional review board at University of North Carolina in compliance with Health Insurance Portability and Accountability Act of 1996 regulations and the Declaration of Helsinki approved this study (institutional review board no. 20-1493, approved as exempt on May 27, 2020). Patient consent was not required, given the nature of this study. Deidentified data were obtained from the NCDB for years 2004 to 2019. Patients with T1N2M0 NSCLC who underwent lobectomy or segmentectomy were identified. We included all patients with T1N2M0 disease, regardless of whether they received neoadjuvant chemotherapy (NACT), in order to increase our sample size and statistical power. Patients who did not receive NACT did not, by definition, receive guideline-concordant care but were included nonetheless. NACT was incorporated in the multivariable regressions to account for its effect. NACT was defined as therapy administered 90 days before surgery. The eighth edition of the American Joint Committee on Cancer TNM classification guidelines were used.[10] Lobectomy and segmentectomy were searched using the codes 33 and 22, respectively.

Baseline patient characteristics and clinical outcomes data were obtained. Categorical variables were expressed as frequencies with corresponding percentages, whereas median and interquartile range (IQR) were used for continuous variables. Baseline patient characteristics among patients who received lobectomy versus segmentectomy were assessed using the χ^2 test for categorical variables and either *t* test (normal distribution) or Wilcoxon rank sum test (non-normal distribution) for continuous variables, depending on the distribution of the relevant data. In addition, nonparametric equality of medians test was used to assess differences in medians of tumor size. Distributions of the data were assessed using visual inspection of histograms with normal curves.

Overall survival was analyzed using the Kaplan-Meier estimator. Unadjusted and adjusted multivariate Cox proportional hazard regression models were used to assess the associations between the risk factors and overall survival between patients who received lobectomy for segmentectomy. Models were adjusted for type of resection, age, sex, margin positivity, Charlson comorbidity index, number of nodes examined, number of positive nodes, and tumor size. A sensitivity analysis with patients who had T1N2M0 tumors that were <2 cm (ie, T1a, T1b) was conducted.

In accordance with the guidelines of the NCDB, counts smaller than 20 were masked after analysis was complete. Statistical analyses were performed with Stata/SE, version 17 (Stata Corp).

RESULTS

Patient and Tumor Characteristics

A total of 2883 individuals with T1N2 disease underwent lobectomy or segmentectomy in the NCDB from 2004 to 2019. The majority (96.5%) of patients received lobectomies (Table 1). Patients undergoing segmentectomy were significantly older, at a median age of 67 years, compared with patients undergoing lobectomy, at a median age of 64 years ($P = .001$). Sex, race/ethnicity, insurance type, median income quartile, and Charlson comorbidity index were similar between patients receiving segmentectomy versus lobectomy.

A significantly greater proportion of patients undergoing segmentectomy had tumors in the lower lobe of the lung (29.0% segmentectomy vs 23.3% lobectomy) and a significantly lower proportion had tumors in the upper lobe (62.0% segmentectomy vs 68.5% lobectomy) compared with patients undergoing lobectomy (both $P = .001$, Table 2). Patients receiving segmentectomy trended toward having a greater proportion of squamous cell cancers (24.0% segmentectomy vs 15.4% lobectomy) and a lower proportion of adenocarcinoma (49.0% segmentectomy vs

TABLE 1. Baseline characteristics of patients with T1N2 non–small cell lung cancer undergoing lobectomy versus segmentectomy, National Cancer Database, 2004-2019

Variable	Segmentectomy, no. (%)	Lobectomy, no. (%)	P value
Overall	100 (3.5)	2783 (96.5)	
Age, y, median [IQR]	67 [61, 73]	64 [57, 70]	.001
Sex			.25
Male	50 (50.0)	1230 (44.2)	
Female	50 (50.0)	1553 (55.8)	
Racial/ethnic group			.99
White	92 (92.0)	2421 (87.0)	
Non-Hispanic Black	7 (7.0)	260 (9.3)	
Other	1 (1.0)	103 (3.7)	
Type of insurance			.08
Not insured	2 (2.0)	43 (1.6)	
Private insurance/ managed care	30 (30.0)	1175 (42.2)	
Medicaid	3 (3.0)	171 (6.1)	
Medicare	63 (63.0)	1325 (47.6)	
Other government	1 (1.0)	34 (1.2)	
Unknown	1 (1.0)	35 (1.3)	
Median income quartiles, 2012-2016			.72
<$40,227	18 (18.0)	411 (14.8)	
$40,227-$50,353	22 (22.0)	514 (18.5)	
$50,354-$63,332	19 (19.0)	603 (21.7)	
≥$63,333	34 (34.0)	920 (33.1)	
Not applicable	7 (7.0)	335 (12.0)	
Charlson comorbidity index			.31
0	53 (53.0)	1686 (60.6)	
1	33 (33.0)	788 (28.3)	
2	9 (9.0)	234 (8.4)	
3	5 (5.0)	75 (2.7)	

IQR, Interquartile range.

TABLE 2. Tumor characteristics of patients with T1N2 non–small cell lung cancer undergoing lobectomy versus segmentectomy, National Cancer Database, 2004-2019

Variable	Segmentectomy, no. (%)	Lobectomy, no. (%)	P value
Tumor site			.001
Main bronchus	0 (0)	10 (0.4)	
Upper lobe, lung	62 (62.0)	1907 (68.5)	
Middle lobe, lung	2 (2.0)	163 (5.9)	
Lower lobe, lung	29 (29.0)	647 (23.3)	
Overlapping lesion of lung	0 (0)	13 (0.5)	
Lung, NOS	7 (7.0)	43 (1.6)	
Histology			.06
Squamous cell	24 (24.0)	429 (15.4)	
Adenocarcinoma	49 (49.0)	1574 (56.6)	
Other	27 (27.0)	780 (28.0)	
Grade			.67
Well differentiated	2 (2.0)	108 (3.9)	
Moderately differentiated	32 (32.0)	900 (32.3)	
Poorly differentiated	41 (41.0)	1082 (38.9)	
Undifferentiated	3 (3.0)	43 (1.6)	
Not applicable	22 (22.0)	650 (23.4)	
Chemotherapy	98 (98.0)	2712 (97.5)	.93
Radiation	57 (57.0)	1906 (68.5)	.015
Neoadjuvant chemotherapy	7 (11.5)	248 (11.8)	.041
Neoadjuvant chemoradiation	12 (19.7)	726 (34.6)	.041

NOS, Not otherwise specified.

56.6% lobectomy); however, these differences did not reach statistical significance ($P = .06$). Tumor grade was similar among patients in the segmentectomy and lobectomy groups ($P = .67$); notably, more than 20% of patients in both groups did not have data on tumor grade.

Treatment Characteristics

The proportion of patients receiving chemotherapy was similar among individuals undergoing segmentectomy versus lobectomy (98.0% segmentectomy vs 97.5% lobectomy, $P = .93$). Compared with patients who received lobectomy, significantly fewer patients who received segmentectomy underwent radiation (57.0% segmentectomy vs 68.5% lobectomy, $P = .015$), neoadjuvant chemotherapy (11.5% segmentectomy vs 11.8% lobectomy, $P = .041$), and neoadjuvant chemoradiation (19.7% segmentectomy vs 34.6% lobectomy, $P = .041$).

A significantly lower proportion of patients undergoing segmentectomy had >10 lymph nodes examined compared with patients undergoing lobectomy (17.0% segmentectomy vs 48.9% lobectomy, $P < .001$, Table 3). For lymph node positivity, a significantly lower proportion of patients receiving segmentectomy had >5 positive nodes compared with patients receiving lobectomy (11.0% segmentectomy vs 22.4% lobectomy, $P < .001$). Notably, more than 10% of patients in both resection groups did not have lymph node examination and positivity data available. Tumor size was similar (median tumor size: 138.8 mm segmentectomy vs 195.4 mm lobectomy, $P = .13$), as well as the status of surgical margins across groups (positive margins: 9.0% segmentectomy vs 6.9% lobectomy, $P = .38$).

Postoperative Outcomes and Survival Analysis

For short-term clinical outcomes, 30-day readmission rates were similar for patients undergoing segmentectomy and lobectomy (2.0% segmentectomy vs 2.9% lobectomy, $P = .27$). A significantly lower proportion of patients undergoing segmentectomy experienced 30-day mortality compared with patients undergoing lobectomy, although this outcome was seen in <1% of patients who underwent lobectomy overall (0% segmentectomy vs 0.57% lobectomy, $P = .047$). Overall survival using the Kaplan-Meier method showed a statistically significant lower risk of death among patients receiving lobectomy compared with

TABLE 3. Clinical characteristics of patients with T1N2 non–small cell lung cancer undergoing lobectomy versus segmentectomy, National Cancer Database, 2004-2019

Variable	Segmentectomy, no. (%)/median (IQR), mm	Lobectomy, no. (%)/median (IQR), mm	P value
Nodes examined			<.001
0	4 (4.0)	44 (1.6)	
1-10	69 (69.0)	1034 (37.2)	
>10	17 (17%)	1362 (48.9)	
Not available	10 (10.0)	343 (12.3)	
Positive nodes			<.001
0	8 (8)	181 (6.5)	
0-5	67 (67)	1677 (60.26)	
>5	12 (12)	634 (22.78)	
Not available	13 (13)	291 (10.46)	
Median tumor size, cm	1.38 ± 3.20	1.95 ± 3.73	.064
Surgical margins			.38
Negative	89 (89.0)	2543 (91.4)	
Positive	9 (9.0)	191 (6.9)	
Not applicable	2 (2.0)	49 (1.8)	
Readmission (30 d)	2 (2.0)	81 (2.9)	.27
Mortality (30 d)	0 (0)	16 (0.6)	.047

IQR, Interquartile range.

segmentectomy (hazard ratio [HR], 0.96; 95% confidence interval [CI], 0.94-0.98, $P = .001$, Figure 1). When restricting the sample to patients with tumors <2 cm (ie, T1a, T1b), overall survival was similarly better for patients receiving lobectomy versus segmentectomy (HR, 0.95; 95% CI, 0.93-0.98, $P = .001$, Figure E1).

Survival analyses were similar in the unadjusted and adjusted sets; therefore, only the multivariable adjusted HRs are reported (Table 4). Compared with patients receiving segmentectomy, all-cause mortality risk was significantly lower among patients receiving lobectomy (adjusted HR, 0.74; 95% CI, 0.58-0.95, $P = .017$) during a median follow-up of 44.6 months (IQR, 23.7, 75.7). These findings were similar on sensitivity analysis with patients who had tumors <2 cm (adjusted HR, 0.58; 95% CI, 0.40-0.83, $P = .003$, Table E1).

In addition, patients who were older had significantly greater risk of death (adjusted HR, 1.02; (5% CI, 1.02-1.03, $P < .001$) and women had significantly lower risk of death compared with men (adjusted HR, 0.82; 95% CI, 1.13-1.63, $P = .001$). There was also a significantly greater risk of death among patients who had positive surgical margins versus negative margins (adjusted HR, 1.36; 95%, CI 1.13-1.63, $P = .001$), Charlson comorbidity index of 2 (adjusted HR, 1.34; 95% CI, 1.14-1.59, $P = .001$) or 3 (adjusted HR, 1.40; 95% CI, 1.06-1.84, $P = .018$) versus a comorbidity score of 0, greater than 5 positive lymph nodes versus 0 positive nodes (adjusted HR, 1.46; 95%, CI 1.29-1.65, $P < .001$), and a larger tumor size (adjusted HR, 1.0; 95% CI, 1.0-1.0, $P = .003$).

DISCUSSION

In this retrospective NCDB analysis of patients with T1N2 NSCLC, the majority were treated with lobectomy as opposed to segmentectomy. Compared with patients undergoing segmentectomy, lobectomy was associated with a significant survival advantage even when adjusting for age, sex, margin positivity, comorbidities, number of lymph nodes examined, number of positive lymph nodes, and tumor size. The survival advantage persisted on sensitivity analysis where the sample was restricted to patients with tumors <2 cm. On the basis of these findings, lobectomy should remain the surgical standard for patients with T1N2M0 NSCLC.

These findings are consistent with the general recommendations in the literature for lobectomy in postneoadjuvant chemotherapy T1N2M0 NSCLC and elucidates the previously reported lack of real-world data against segmentectomy in this patient population.[11] Despite an increasingly robust body of research supporting parenchymal preservation with sublobar resection in T1N0 disease,[3,4,12] segmentectomy cannot be safely recommended in patients with N2 disease. The survival advantage observed among patients undergoing lobectomy may be attributable to achieving a greater rate of R0 resections with resection of additional lung parenchyma and lymph nodes. It is worth noting there was a greater proportion of patients in the lobectomy cohort who received neoadjuvant chemotherapy and radiation compared with the segmentectomy cohort; however, the high percentage of chemotherapy treatment (>97%) in both groups suggests the survival differential is more likely the result of surgical approach rather than a function of systemic chemotherapy.

Although not surprising, the results of our study are somewhat contradictory to those reported by Razi colleagues,[9] in which survival was similar in patients undergoing lobectomy versus segmentectomy in clinically T1N0 patients who had occult N1/N2 metastasis. In our study, patients in the segmentectomy cohort had fewer lymph nodes examined and thus fewer positive lymph nodes reported. This may represent greater disease burden that went unexamined and potentially left behind in the segmentectomy cohort, affecting overall survival. Indeed, if positive nodal disease has some prognostic value, as demonstrated in previous studies and in our survival analysis, then identifying and excising more positive lymph nodes should confer a survival advantage.[13,14] However, as noted in Boffa and Salazar's response[15] to Razi and colleagues, surgeon decision-making is not captured in the NCDB and thus the applicability of these lymph node findings is unclear.

Our study findings also suggest that patients undergoing lobectomy have superior survival outcomes despite having

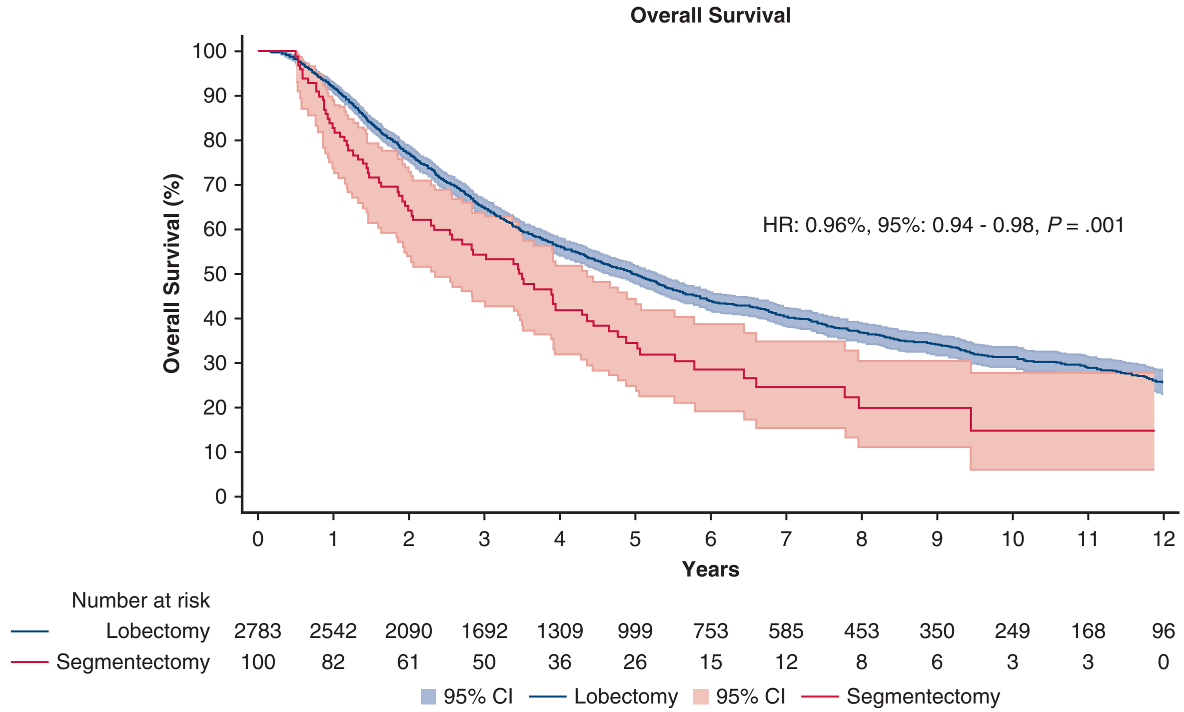

FIGURE 1. Overall survival for patients with T1N2 non–small cell lung cancer undergoing lobectomy versus segmentectomy, National Cancer Database, 2004-2019. *CI*, Confidence interval; *HR*, hazard ratio.

greater 30-day mortality compared with patients undergoing segmentectomy. The 30-day mortality outcomes were low overall (<1% in the lobectomy cohort); however, the long-term survival advantage conferred by lobectomy outweighed the short-term risks. Nonetheless, it is important to note that although the 30-day mortality differences were statistically significant across the 2 groups (HR, 0.96; 95% CI, 0.94-0.98, $P = .001$), the clinical significance of these findings may be less stark in practice. Although the benefits of a more aggressive surgical approach (ie, lobectomy as opposed to segmentectomy) may be countered by the benefits of resecting less parenchyma for patients who are clinically T1N0 with occult nodal metastasis,[9,15] this does not appear to be the case for patients with clinically T1N2 disease, even with tumors <2 cm. These differences underscore the importance of lymph node evaluation before and during surgery to determine the appropriate resection.

Although lobectomy should remain the surgical standard for patients with T1N2 disease, the role of emerging systemic therapy on surgical decision-making remains unknown. For example, select patients who respond well to neoadjuvant chemotherapy and immuno-oncology (IO) may become candidates for segmentectomy in the future. Nivolumab shows promising survival advantages in patients with resectable stage IB-IIIA NSCLC, and whether sublobar resection could be considered in patients who have excellent responses to neoadjuvant chemotherapy and IO is yet to be determined.[16,17] The number of patients who received IO was too small to conduct meaningful statistical analysis in this study. Future studies should consider multi-institutional approaches to assess how IO may alter surgical candidacy among patients with resectable early-stage NSCLC.

Limitations

There are several limitations associated with this study. Although the NCDB captures more than 70% of newly diagnosed cancers in the United States,[18] the database is derived from hospital-level clinical data and is potentially subject to coding errors. Specific data on pulmonary function tests, lymph node stations, anatomic segments with tumor present, anatomic segments resected during surgery, and tumor location (ie, central or peripheral) are not captured. In addition, rates of nodal and tumor upstaging, and the rationale behind surgical decisions for segmentectomy versus lobectomy, are not fully captured, potentially biasing our findings. Further, many patients had no data on the number of lymph nodes examined or the number of positive lymph nodes. All of these factors are important considerations for surgical planning and should be followed up with studies that can better contextualize the findings herein.

As stated previously, the reasoning behind surgeon operative approach cannot be ascertained from the NCDB.

TABLE 4. Unadjusted and adjusted survival between lobectomy and segmentectomy

Characteristic	Unadjusted HR	95% CI LCL	95% CI UCL	*P* value	Adjusted HR	95% CI LCL	95% CI UCL	*P* value
Type of resection								
Segmentectomy	ref	ref	ref	ref	ref	ref	ref	ref
Lobectomy	0.66	0.55	0.78	<.001	0.74	0.58	0.95	.017
Age	1.03	1.02	1.03	<.001	1.02	1.02	1.03	<.001
Sex								
Male	ref	ref	ref	ref	ref	ref	ref	ref
Female	0.77	0.73	0.82	<.001	0.82	0.75	0.90	<.001
Margins								
Negative	ref	ref	ref	ref	ref	ref	ref	ref
Positive	1.58	1.43	1.75	<.001	1.36	1.13	1.63	.001
Not applicable	1.08	0.88	1.32	.47	1.21	0.88	1.67	.24
Charlson comorbidity index								
0	ref	ref	ref	ref	ref	ref	ref	ref
1	1.09	0.98	1.21	.127	1.05	0.94	1.18	.35
2	1.39	1.17	1.64	<.001	1.34	1.14	1.59	.001
3	1.43	1.09	1.88	.011	1.40	1.06	1.84	.018
Nodes examined								
0	ref	ref	ref	ref	ref	ref	ref	ref
1-10	1.41	0.97	2.06	1.79	1.22	0.75	1.97	.43
>10	1.28	0.88	1.87	1.29	1.01	0.63	1.64	.96
Not available	1.11	0.75	1.66	.53	1.06	0.70	1.61	.79
Positive nodes								
0	ref	ref	ref	ref	ref	ref	ref	ref
0-5	1.14	0.97	1.32	.12	0.98	0.83	1.16	.82
>5	1.39	1.23	1.56	<.001	1.46	1.29	1.65	<.001
Not available	0.88	0.75	1.04	.14	0.95	0.72	1.26	.74
Tumor size	1.00	1.00	1.00	.007	1.00	1.00	1.00	.003

Adjustment set: type of resection, age, sex, margin positivity, Charlson comorbidity index, number of lymph nodes examined, number of positive lymph nodes, and tumor size. *HR*, Hazard ratio; *CI*, confidence interval; *LCL*, lower confidence limit; *UCL*, upper confidence limit; *ref*, reference.

Given segmentectomy for N2 disease has not been historically common, understanding the reasoning behind these decisions may elucidate useful information on which patients were selected for a particular surgery and why they did or did not benefit from it. It is possible that patients in the segmentectomy cohort received this surgical approach due to their inability to tolerate a more invasive operation (either as the result of poor pulmonary function tests or poor baseline functional status) and obtaining more granular patient-level data through multi-institutional studies may contextualize these findings further. Nonetheless, the NCDB's breadth of clinical data allows us to appreciate clear trends in survival for patients with T1N2 disease and support current guidelines for lobectomy in these patients.

CONCLUSIONS

In this retrospective analysis of the NCDB, lobectomy was more commonly performed compared with segmentectomy for patients with T1N2 NSCLC. Lobectomy offered a significant survival advantage over segmentectomy, and this remained true when adjusting for known risk factors such as age, nodal positivity, and surgical margins. Thus, these findings suggest that lobectomy may be a superior resection of choice for patients with T1N2 disease.

Conflict of Interest Statement

The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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Key Words: non–small cell lung cancer, lobectomy, segmentectomy, sublobar resection

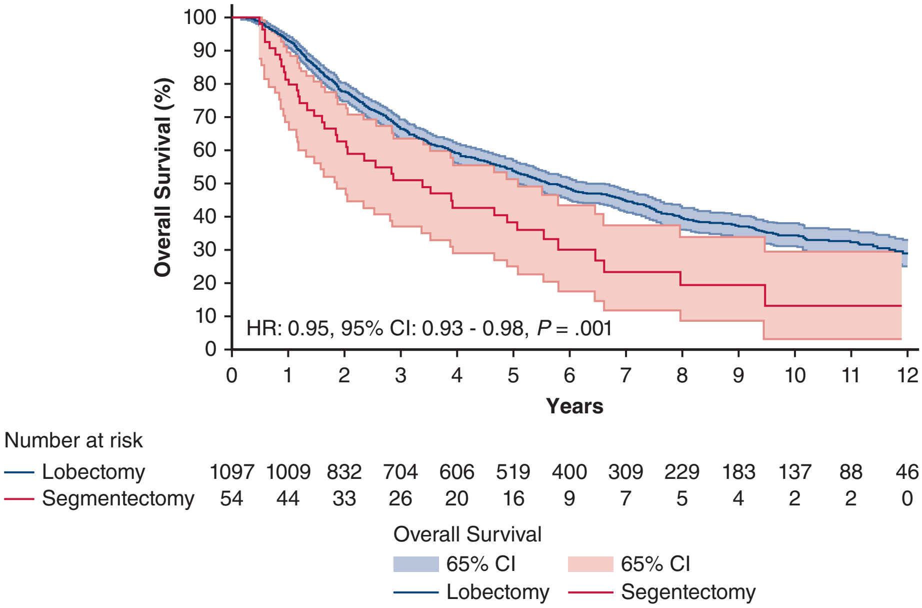

FIGURE E1. Overall survival for patients with T1N2 non–small cell lung cancer undergoing lobectomy versus segmentectomy, National Cancer Database, 2004-2019—restricted to patients with tumors <2 cm. *CI*, Confidence interval; *HR*, hazard ratio.

TABLE E1. Unadjusted and adjusted survival analysis by lobectomy versus segmentectomy—restricted to patients with tumors <2 cm

Characteristic	Unadjusted HR	95% CI		*P* value	Adjusted HR	95% CI		*P* value
		LCL	UCL			LCL	UCL	
Type of resection								
Segmentectomy	ref	ref	r ref	ref	ref	ref	ref	ref
Lobectomy	0.56	0.39	0.79	.001	0.58	0.40	0.83	.003
Age	1.02	1.01	1.03	<.001	1.02	1.01	1.03	<.001
Sex								
Male	ref	ref	ref	ref	ref	ref	ref	ref
Female	0.82	0.69	0.97	.02	0.85	0.71	1.01	.065
Margins								
Negative	ref	ref	ref	ref	ref	ref	ref	ref
Positive	1.57	1.12	2.22	.01	1.51	1.07	2.14	.02
Not applicable	1.98	1.18	3.31	.01	2.04	1.19	3.47	.009
Charlson-Deyo Score								
0	ref	ref	ref	ref	ref	ref	ref	ref
1	0.96	0.78	1.17	.67	0.95	0.77	1.16	.614
2	1.55	1.17	2.05	.002	1.45	1.09	1.94	.011
3	1.24	0.76	2.02	.39	1.24	0.76	2.02	.40
Nodes examined								
0	ref	ref	ref	ref	ref	ref	ref	ref
1-10	1.22	0.68	2.18	1.79	1.15	0.52	2.51	.734
>10	1.25	0.70	2.23	1.29	1.07	0.49	2.33	.869
Not available	0.95	0.51	1.77	.53	0.96	0.50	1.84	.91
Positive nodes								
0	ref	ref	ref	ref	ref	ref	ref	ref
0-5	1.19	0.92	1.55	.18	1.04	0.78	1.39	.779
>5	1.81	1.47	2.24	<.001	1.85	1.48	2.31	<.001
Not available	0.93	0.69	1.24	.63	1.03	0.63	1.69	.902
Tumor size	1.00	0.97	1.02	.78	0.99	0.97	1.02	.697

Adjustment set: type of resection, age, sex, margin positivity, Charlson comorbidity index, number of lymph nodes examined, number of positive lymph nodes, and tumor size. *HR*, Hazard ratio; *CI*, confidence interval; *LCL*, lower confidence limit; *UCL*, upper confidence limit; *ref*, reference.