

Treatment trends in early-stage lung cancer in the United States, 2004 to 2013: A time-trend analysis of the National Cancer Data Base



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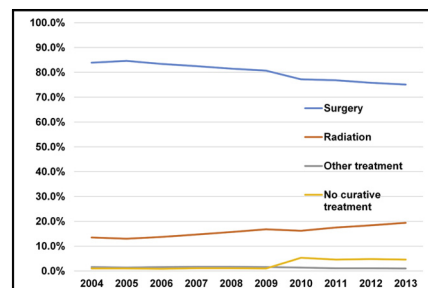
ABSTRACT

Objective: The study objective was to evaluate trends in the use of surgical therapy for patients with early-stage (IA-IIA) non–small cell lung cancer when stereotactic ablative radiotherapy was introduced in the United States.

Methods: Patients with clinical stage IA to IIA non–small cell lung cancer diagnosed from January 1, 2004, to December 31, 2013, were identified in the National Cancer Data Base. The Cochran–Armitage trend test was used to evaluate the change in the proportion of patients undergoing surgery over time. Logistic regression was used to identify the factors associated with receipt of surgery compared with radiation.

Results: Of 200,404 eligible patients from 1235 hospitals, 79.8% (n = 159,943) underwent surgery. For all stages combined, the rate of surgery decreased from 83.9% in 2004 to 75.1% in 2013 ($P < .0001$), with the largest decrease seen in patients with stage IIA: stage IA 86.5% to 77.1% ($P < .0001$); stage IB 79.6% to 71.5% ($P < .0001$); and stage IIA 94.7% to 70.3% ($P < .001$). Patients were more likely to undergo surgery if they were younger and white, had higher income, or had private or Medicare insurance.

Conclusions: From 2004 to 2013, there was an overall decrease in the use of surgical therapy for lung cancer in early-stage disease. Because resection remains the standard of care for most patients with early-stage disease, these data suggest a potentially significant quality gap in the treatment of patients with non–small cell lung cancer. (*J Thorac Cardiovasc Surg* 2018;156:1233-46)



National trend in management of stage IA to IIA NSCLC from 2004 to 2013.

Central Message

The past decade saw a decreased use of surgical therapy for lung cancer in early-stage disease even though resection remains the standard of care for most of these patients.

Perspective

The recent decline in use of surgical therapy for early-stage NSCLC demands further evaluation of patient, physician, and system factors influencing treatment choice. Determining the cause of this quality gap requires innovative research methodology because of limitations of currently available datasets.

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Lung cancer is the leading cause of cancer-related death in the United States with 224,390 new cases and 158,080 deaths estimated in 2016.¹ For patients with early-stage (stage IA-IIA) non–small cell lung cancer (NSCLC), surgical resection

provides the best chance for cure.² However, because of the etiology of lung cancer, many patients have age- and smoking-related comorbidities, contributing to increased surgical risk. Although some of these patients are clearly

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Abbreviations and Acronyms

CoC	= Commission on Cancer
NCDB	= National Cancer Data Base
NSCLC	= non–small cell lung cancer
SABR	= stereotactic ablative radiotherapy



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not surgical candidates because of medical comorbidity, there remains a large cohort for whom the decision to operate is not clear-cut. Because of the aging US population and current screening guidelines supporting the use of computed tomography in groups at high risk for lung cancer, the number of potentially resectable lung cancers in these moderate-risk patients is expected to increase.

In the past decade, stereotactic ablative radiotherapy (SABR) has emerged as an alternate to surgical therapy for high medical risk patients with localized disease. SABR delivers focused external beam radiation at ablative doses in 1 to 5 fractions.³ Treatment is completed in an outpatient setting over approximately 2 weeks. The benefits over traditional radiation therapy include a focused treatment target, minimizing radiation-induced damage to adjacent parenchyma, and a shorter treatment schedule thereby reducing inconvenience to the patient.⁴ Survey data suggest approximately half of radiation oncologists were routinely using SABR for patients with NSCLC by 2008.⁵ Multiple analyses, including meta-analyses and Markov decision models, have suggested outcomes comparable to resection in medically inoperable patient populations with regard to locoregional control, disease-free survival, and overall survival.^{4,6-11} However, randomized clinical trials evaluating SABR for potentially operable patients have failed to accrue patients and have closed early (STARS trial [NCT00840749], ROSEL trial [NCT00687986], and ACOSOG Z4099 trial [NCT01336894]).¹²⁻¹⁴ When treatment technology evolves more rapidly than randomized clinical trials can be completed, treatment trends in the community do not always reflect the available level 1 data.¹⁵

Despite current evidence, little is known about the effect that the introduction of SABR has had on the use of surgery for early-stage lung cancer. By using the National Cancer Data Base (NCDB), we sought to determine the following for patients treated in the United States: (1) the trend in

the rate of surgical therapy, as well as alternate treatment modalities, for patients with early-stage (IA-IIA) NSCLC; (2) the reported reasons for not receiving surgery, as documented in the NCDB; and (3) the identification of factors associated with receipt of surgery compared with radiation.

MATERIALS AND METHODS**Data Source**

Data were obtained from the NCDB, a joint program of the American College of Surgeons and American Cancer Society. The largest cancer registry in the world, the NCDB is estimated to capture approximately 70% of all new cancer diagnoses in the United States and Puerto Rico, including 82% of lung cancer diagnoses.¹⁶ Data are collected by Certified Tumor Registrars who undergo extensive training and are audited to ensure accuracy of the database. Hospital and patient identity are protected and not included in the Participant Use File. Data released in the Participant Use File are in compliance with the privacy requirements of the Health Information Portability and Accountability Act. The Institutional Review Board at Northwestern University determined this study was exempt because it uses publicly available de-identified data.

Patient Selection

The 2014 NCDB Participant Use File was queried to identify patients diagnosed with NSCLC from January 1, 2004, to December 31, 2013. We included all patients with a clinical or pathologic stage of IA to IIA NSCLC, as determined by the American Joint Committee on Cancer 6th or 7th Edition *Cancer Staging Manual*, which do not differ with respect to staging for our patient population of focus.¹⁷ Patients with clinical N1 disease were excluded because they would not be candidates for SABR. If there were discrepancies between clinical and pathologic stage determination, we preferentially used clinical stage to reflect the information available at the time a treatment decision was made. We excluded patients with missing treatment data (n = 29,277, 2.5%). In addition, patients with previous cancers, recurrent cancer, or possible metastatic disease from an extrathoracic primary tumor were excluded from the analysis because these groups were thought to represent a biologically distinct disease process (n = 92,450; 7.9%). Trends in care were analyzed for the entire patient cohort. Regression modeling focused on the most recent 3 years to most closely reflect decision making in current use patterns.

Treatment Modalities

We grouped eligible patients by the primary treatment modality used for their primary tumor. Surgical patients include those who underwent sublobar resection (including segmentectomy and wedge resection), lobar or bilobar resection, or pneumonectomy. We did not differentiate between the various radiation protocols because the ideal protocol for SABR is still being defined, protocols varied when this modality was introduced, and, as a result, abstraction may have been inconsistent.⁹ Thus, patients coded as receiving radiation therapy included both SABR and any other form of radiation therapy. It should be emphasized that throughout this article “radiation” refers to all forms of radiation therapy where “SABR” will refer specifically to stereotactic ablative radiotherapy. The “Other” category includes patients who were documented to have received treatment with curative intent, for example, radiofrequency ablation or doublet chemotherapy. The patients included in the “No curative treatment” group included patients who received single-agent chemotherapy regimens, hormonal therapy, or immunotherapy, as well as patients undergoing active surveillance.

Statistical Analysis

In the unadjusted analysis, we performed a Cochran–Armitage trend test for the proportion of patients who received surgery for each stage category from 2004 to 2013. Each year was considered as a separate cohort to maintain

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