

Does surgeon experience affect outcomes in pathologic stage I lung cancer?

Paul J. Scheel III, BS, Traves D. Crabtree, MD, Jennifer M. Bell, BSN, Christine Frederiksen, MS, Stephen R. Broderick, MD, A. Sasha Krupnick, MD, Daniel Kreisel, MD, PhD, G. Alexander Patterson, MD, Bryan F. Meyers, MD, MPH, and Varun Puri, MD, MSCI

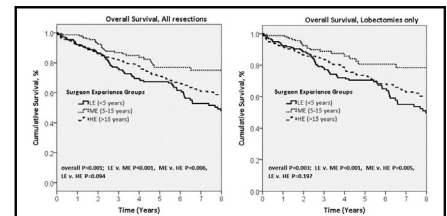
ABSTRACT

Objective: The study objective was to evaluate the influence of surgeon experience on outcomes in early-stage non–small cell lung cancer.

Methods: In an institutional database, patients undergoing operations for pathologic stage I non–small cell lung cancer were categorized by surgeon experience: within 5 years of completion of training, the low experience group; with 5 to 15 years of experience, the moderate experience group; and with more than 15 years, the high experience group.

Results: From 2000 to 2012, 800 operations (638 lobectomies, 162 sublobar resection) were performed with the following distribution: low experience 178 (22.2%), moderate experience 224 (28.0%), and high experience 398 (49.8%). Patients in the groups were similar in age and comorbidities. The use of video-assisted thoracoscopic surgery was higher in the moderate experience group (low experience: 62/178 [34.8%], moderate experience: 151/224 [67.4%], and high experience: 133/398 [33.4%], $P < .001$), as was the mean number of mediastinal (N2) lymph node stations sampled (low experience: 2.8 ± 1.6 , moderate experience: 3.5 ± 1.7 , high experience: 2.3 ± 1.4 , $P < .001$). The risk of perioperative morbidity was similar across all groups (low experience: 54/178 [30.3%], moderate experience: 51/224 [22.8%], and high experience: 115/398 [28.9%], $P = .163$). Five-year overall survival in the moderate experience group was 76.9% compared with 67.5% in the low experience group ($P < .001$) and 71.4% in the high experience group ($P = .006$). In a Cox proportional hazard model, increasing age, male gender, prior cancer, and R1 resection were associated with an elevated risk of mortality, whereas being operated on by surgeons with moderate experience and having a greater number of mediastinal (N2) lymph node stations sampled were protective.

Conclusions: The experience of the surgeon does not affect perioperative outcomes after resection for pathologic stage I non–small cell lung cancer. At least moderate experience after fellowship is associated with improved long-term survival. (J Thorac Cardiovasc Surg 2015;149:998-1004)



Kaplan-Meier survival curves for all resections of pathologic stage 1 NSCLC.

Central Message

Moderate surgeon experience is associated with greater use of VATS, higher LN yield, and improved 5-year survival in stage 1 NSCLC.

Perspective

The impact of surgeon experience on outcomes in stage 1 NSCLC resection remains inadequately studied. We identify surgeon-specific factors associated with improved outcomes, which draws attention to potentially modifiable aspects of patient care. Surgeon training in VATS and adequate LN dissection along with early career supervision provide potential interventions for improved patient care.

See Editorial Commentary page 1005.

From the Division of Cardiothoracic Surgery, Department of Surgery, Washington University School of Medicine, St Louis, Mo.
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Address for reprints: Varun Puri, MD, MSCI, 3108 Queeny Tower, Barnes Jewish Hospital, One Barnes Jewish Hospital Plaza, St Louis, MO 63110 (E-mail: puriv@wudosis.wustl.edu).

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Surgical and institutional factors seem to influence morbidity and mortality in resection for esophageal, pancreas, colon, and lung cancers.¹⁻¹¹ Several authors have studied surgeon and hospital volumes, and surgeon specialization as possible influential variables, with some reports demonstrating decreased mortality with higher surgical volume and greater degree of surgeon

Abbreviations and Acronyms

HE	= high experience
LE	= low experience
ME	= moderate experience
NSCLS	= non-small cell lung cancer
VATS	= video-assisted thoracoscopy

specialization.^{6,8,11} This is particularly true in surgery for early-stage non-small cell lung cancer (NSCLC).^{2,10-13}

However, previous studies evaluating the impact of the individual surgeon on outcomes in lung cancer have focused mainly on thoracic surgical specialization and surgical volume.¹⁰⁻¹⁴ The role of increasing surgical experience over time as an independent practitioner remains largely unknown. In addition, these studies have largely reported on postoperative mortality, with considerably less attention on perioperative morbidity.^{4,10,11} Because postoperative morbidity is more common than mortality after pulmonary resection (20%-40% vs 1%-3%),^{12,15} the impact of the individual surgeon on early postoperative outcomes remains inadequately understood.

We evaluated the impact of surgeon experience accrued after cardiothoracic surgery fellowship training on the morbidity and mortality of patients undergoing curative resection for pathologic stage I NSCLC. We hypothesized that patients undergoing operations by less-experienced surgeons would demonstrate increased perioperative morbidity and long-term mortality.

PATIENTS AND METHODS

With institutional review board approval, a single-center, retrospective review of a prospectively maintained lung cancer database was performed. Inclusion criteria were patients who underwent initial resection by lobectomy or sublobar resection for resection of pathologic stage I NSCLC lung cancer and operation performed between January 2000 and December 2012 at Washington University School of Medicine. Only pathologic stage I was included to ensure a uniform population to prevent confounding from upstaging and downstaging. We chose a start date of 2000 for this study because electronic patient records first became available for review at the time. Exclusion criteria included pneumonectomies, operations for recurrent cancer, resections involving multilobes, and operations for subsequent primary cancers in patients who had undergone a prior lung resection (Figure E1).

Surgical experience was determined on the basis of the number of years after the completion of a cardiothoracic surgery fellowship for the operating surgeon at the time of surgery. Operations conducted within the first 5 years of practice after specialty training for the surgeon were classified as the low experience (LE) group; operations performed by surgeons with 5 to 15 years of experience were classified as the moderate experience (ME) group; and operations performed by surgeons with more than 15 years of post-fellowship experience were classified as the high experience (HE) group. Thus, cases performed by a single surgeon could be in different groups depending on when a particular operation was performed in that surgeon's postfellowship career.

We abstracted the details of patient demographics, diagnosis, workup, operation, perioperative course, and outcomes from the institutional

database. Missing data were obtained by review of patient charts. Perioperative events were defined per the Society of Thoracic Surgeons data-collection guidelines.¹⁶ Patient survival was determined from clinic notes and supplemented by querying the Social Security Death Index.

Statistics

Data were managed with Microsoft Excel (Microsoft Corp, Redmond, Wash) and analyzed using SPSS 21.0 for Windows (SPSS Inc, Chicago, Ill). Descriptive statistics were expressed as mean \pm standard deviation unless otherwise specified. Categorical data were expressed as counts and percentages. Comparisons between normally distributed continuous variables were performed with 1-way analysis of variance or the *t* test, and differences among the categorical data were analyzed with the chi-square test. Post hoc analyses for pairwise comparisons were performed using the Bonferroni method for categorical data and the Tukey method for continuous variables. Kaplan-Meier survival plots were generated and groups were compared using the log-rank test. For pairwise comparisons using the Bonferroni method, a *P* value less than .017 was considered significant. A Cox proportional hazard model was then fitted to determine variables that affected the risk of long-term mortality. For this model, we considered age, gender, smoking status, coronary artery disease, hypertension, forced expiratory volume in 1 second percent, diffusing capacity of carbon monoxide percent, body mass index, prior cancer, surgeon experience, procedure (lobectomy vs sublobar resection), adequacy of resection (negative margins), number of mediastinal (N2) lymph node stations sampled, and type of incision (video-assisted thoracoscopy [VATS] vs thoracotomy) as independent variables.

After an initial exploratory analysis of all patients with pathologic stage I lung cancer who underwent resection, we dichotomized patients into a lobectomy group and a sublobar resection group. Identical analyses as described earlier were performed in these groups. We also performed a subgroup analysis to determine whether there was an impact of accrued experience for each individual surgeon.

For those surgeons who began performing operations during the study period, their first 25 operations were compared with their subsequent 25 operations with a comparison of both preoperative variables and outcomes.

RESULTS

Between January 2000 and December 2012, 800 patients underwent resection for pathologic stage I lung cancer by 8 surgeons. Of these operations, 178 resections (22.2%) were in the LE group (<5 years experience for the operating surgeon), 224 resections (28.0%) were in the ME group (5- \leq 15 years experience for the surgeon), and 398 resections (49.8%) were in the HE group (15 years experience for the surgeon). Operations were performed by 6 different surgeons in the LE group, 5 surgeons in the ME group, and 2 surgeons in the HE group. Patients in the 3 groups were similar in age and distribution of comorbidities (Table 1). The LE group had a higher proportion of male patients and nonwhite patients than the HE group (Table 1).

Of the 800 operations, there were 638 lobectomies (79.8%) and 162 sublobar resections (20.2%). The LE group was more likely to undergo lobectomies than sublobar resections (157/178 [88.2%]) compared with the ME group (176/224 [78.6%], *P* = .011) and HE group (305/398 [76.6%], *P* = .001). The use of VATS was higher in the ME group than in the other 2 groups (LE: 62/178 [34.8%], ME: 151/224 [67.4%], HE: 133/398 [33.4%],

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