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Comparison of Surgical Outcomes and Survival between Octogenarians and Younger Patients after Pulmonary Resection for Stage I Lung Cancer

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Background: Treatment strategies for octogenarians with lung cancer remain controversial. The purpose of this study was to compare surgical outcomes and survival between octogenarians and younger patients with stage IA and IB lung cancer. **Methods:** We reviewed the medical records of 34 consecutive octogenarians and 457 younger patients (<70 years) with stage I lung cancer who underwent surgical resection from January 2007 to December 2015. We analyzed the survival and surgical outcomes of the 2 groups according to the lung cancer stage (IA and IB). **Results:** The only significant differences in the clinicopathological features between the groups were the higher proportion of sublobar resection (56.3% vs. 18.9%) and the smaller number of dissected lymph nodes (LNs) in octogenarians. There was no significant difference in hospital stay (11 days vs. 9 days), pneumonia (5.8% vs 1.9%), or operative mortality (0% vs 0.6%) between the 2 groups. Among patients with stage IA lung cancer, 5-year recurrence-free survival was not significantly different between the octogenarians (n=16) and younger patients (n=318) (86.2% vs. 89.1%, p=0.548). However, 5-year overall survival was significantly lower in octogenarians than in younger patients (79.4% vs. 93.4%, p=0.009). Among patients with stage IB lung cancer, there was no significant difference in 5-year recurrence-free survival (62.1% vs. 73.5%, p=0.55) or overall survival (77.0% vs 85.0%, p=0.75) between octogenarians (n=18) and younger patients (n=139). In multivariable analysis, male sex, the number of dissected LNs, and tumor size were factors related to survival (hazard ratio [HR], 5.795; p=0.017; HR, 0.346, p=0.025; and HR, 1.699; p=0.035, respectively). **Conclusion:** Surgical outcomes and survival after pulmonary resection for stage I lung cancer were comparable in octogenarians and younger patients. Continued careful selection of octogenarians for pulmonary resection is important to achieve good results.

Key words: 1. Aged, 80 and over
2. Non-small cell lung cancer
3. Surgery
4. Survival
5. Mortality

Introduction

With developments in health care in recent decades, the elderly population has also increased. Even the definition of the elderly population has changed, from 65 years to over 70 years [1]. Lung cancer is

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the leading cause of cancer-related deaths worldwide, and the number of older patients with lung cancer is growing faster than before. Roughly 14% of lung cancer patients have been reported to be aged 80 years or older [2,3].

The best choice for early-stage lung cancer is surgery. However, surgical treatment of lung cancer in elderly patients often leads to increased postoperative morbidity and poor quality of life [4]. The treatment strategies for lung cancer in octogenarians remain controversial. Treatment decisions are influenced by the patient's age, cancer stage, performance status, survival, and quality of life [5].

To better understand the practical benefit of lung resection in patients older than 80 years and to determine guidelines and risk factors for treatment, we evaluated the surgical outcomes and survival after surgical resection in elderly patients with stage I non-small cell lung cancer (NSCLC) who underwent complete pulmonary resection. These results were compared with younger patients who had similar operative risks and underwent similar types of resections.

Methods

This was a retrospective observational study performed at a single center and approved by the hospital's institutional review board. We reviewed the medical records of 34 consecutive octogenarians (80 years and older) and 457 younger patients (70 years and younger) with pathologic stage IA and IB lung cancer (American Joint Committee on Cancer [AJCC] TNM, seventh edition) who underwent complete pulmonary resection from January 2007 to December 2015. Complete resection was defined as absence of macroscopic and microscopic residual cancer in the resection margin.

We compared the surgical outcomes and survival after surgical resection between patients with lung cancer who were aged 80 years and over and those with lung cancer who were aged 50–70 years. Patients with other pathologic types of cancer (except adenocarcinoma and squamous cell carcinoma), who underwent neoadjuvant chemotherapy, or in whom R0 resection failed were excluded.

The surgical procedures included wedge resection, segmentectomy, lobectomy, and bilobectomy. Sublobar resection included wedge resection and segmentectomy. Adjuvant treatment was performed when the tumor size was more than 4 cm and chest wall invasion was suspected, and when the resection margin was too close.

Clinicopathological and surgical characteristics such as age, sex, smoking history, other cancer history, serum carcinoembryonic antigen level, maximum standardized uptake value (SUVmax), preoperative pulmonary function tests including forced expiratory volume in 1 second and diffusing capacity for carbon monoxide, tumor location, tumor size, type of pulmonary resection, histology, differentiation, and number of dissected lymph nodes (LNs) were evaluated.

The surgical outcome variables were operative mortality, length of hospital stay, and perioperative complications such as prolonged air leakage, stroke, pneumonia, and respiratory distress that occurred before discharge.

All patients were followed from the day of surgery. They were examined by chest X-ray every 3 months and by chest computed tomography (CT) every 6 months for the first 2 years. Thereafter, they were examined by low-dose chest CT every 6 months until 5 years. After 5 years, they were examined by low-dose chest CT annually.

Overall cancer-related survival was compared between the octogenarians and the younger patients groups. An analysis was performed to determine the risk factors that influenced the survival of patients with stage IA and IB lung cancer.

Patients' characteristics and demographics were summarized, and the chi-square and Student t-tests were used to compare the characteristics of each group statistically. The probability of survival was estimated using the Kaplan-Meier method. The log-rank test was used to compare different curves statistically. A p-value less than 0.05 was considered to indicate statistical significance. All the significant variables from this univariate method, together with some other already established significant variables, were analyzed in a multivariate analysis using proportional hazard regression analysis for survival data.

Results

1) Patient characteristics

The median follow-up time for all patients was 3.5

Table 1. Comparison of clinicopathological characteristics in patients with stage IA non-small cell lung cancer according to age

Characteristic	Octogenarians (n=16)	Age 50–70 yr (n=318)	p-value
Age (yr)	81.9±3.1	61.2±5.5	<0.001
Sex			0.070
Male	12 (75.0)	156 (49.1)	
Female	4 (25.0)	162 (50.9)	
Former smoker or current smoker	11 (68.8)	193 (60.7)	0.607
Other cancer history	6 (37.5)	92 (28.9)	0.574
Serum carcinoembryonic antigen level (ng/mL)	4.3±6.5	2.4±5.4	0.222
Maximum standardized uptake value	6.7±4.7	3.5±3.6	0.004
Forced expiratory volume in 1 second (%)	103.1±17.2	97.8±17.2	0.226
Diffusing capacity of the lung for carbon monoxide (%)	82.2±19.9	87.6±18.3	0.299
ECOG score[a)]	0	0.02±0.1	0.581
Involved lobe			0.140
Right upper	5 (31.3)	115 (36.2)	
Right middle	0	24 (7.5)	
Right lower	1 (6.3)	60 (18.9)	
Left upper	8 (50.0)	67 (21.1)	
Left lower	2 (12.5)	52 (16.4)	
Tumor location			0.359
Central	2 (12.5)	24 (7.5)	
Peripheral	14 (87.5)	294 (92.5)	
Video-assisted thoracoscopic surgery	15 (93.8)	238 (74.8)	0.131
Open thoracotomy	1 (6.3)	80 (25.2)	
Procedure			0.005
Wedge resection	5 (31.3)	40 (12.6)	
Segmentectomy	4 (25.0)	20 (6.3)	
Lobectomy	7 (43.8)	249 (78.3)	
Bilobectomy	0	9 (2.8)	
Mediastinal LNs			0.145
No evaluation	6 (37.5)	63 (19.8)	
Sampling	3 (18.8)	49 (15.4)	
Dissection	7 (43.8)	206 (64.8)	
Pleural adhesion			0.224
None	9 (56.3)	232 (73.0)	
Partial	5 (31.3)	52 (16.4)	
Total	2 (12.5)	34 (10.7)	
Tumor size (cm)	1.8±0.6	1.8±0.6	0.565
Histology			0.088
Adenocarcinoma	12 (75.0)	285 (89.6)	
Squamous cell carcinoma	4 (25.0)	33 (10.4)	
Differentiation			0.021
Well	5 (31.3)	167 (52.5)	
Moderate	7 (43.8)	130 (40.9)	
Poor	4 (25.0)	21 (6.6)	
No. of dissected LNs	6.4±7.6	10.7±7.7	0.031
Pathologic stage			0.417
T1aN0M0	9 (56.3)	214 (67.3)	
T1bN0M0	7 (43.8)	104 (32.7)	

Table 1. Continued

Characteristic	Octogenarians (n=16)	Age 50–70 yr (n=318)	p-value
Visceral pleural invasion	0	0	
Lymphatic invasion	7 (43.8)	72 (22.6)	0.069
Vascular invasion	1 (6.3)	13 (4.1)	0.504

Values are presented as median±standard deviation or number (%).
LN, lymph node.
[a)]Eastern Cooperative Oncology Group performance status.

Table 2. Comparison of clinicopathological characteristics in patients with stage IB non-small cell lung cancer according to age

Characteristic	Octogenarians (n=18)	Age 50–70 yr (n=139)	p-value
Age (yr)	82.3±2.1	62.6±5.5	<0.001
Sex			0.464
Male	8 (44.4)	75 (54.0)	
Female	10 (55.6)	64 (46.0)	
Former smoker or current smoker	7 (38.9)	51 (36.7)	1.000
Other cancer history	3 (16.7)	35 (25.2)	0.565
Serum carcinoembryonic antigen level (ng/mL)	4.3±4.0	3.0±4.1	0.243
Maximum standardized uptake value	7.0±3.3	6.4±4.9	0.655
Forced expiratory volume in 1 second (%)	98.0±19.8	93.3±18.8	0.319
Diffusing capacity of the lung for carbon monoxide (%)	82.1±19.9	87.2±20.0	0.334
ECOG scorea)	0	0.04±0.2	0.372
Involved lobe			0.990
Right upper	6 (33.3)	43 (30.9)	
Right middle	2 (11.1)	18 (12.9)	
Right lower	4 (22.2)	28 (20.1)	
Left upper	4 (22.2)	28 (20.1)	
Left lower	2 (11.1)	22 (15.8)	
Tumor location			0.740
Central	2 (11.1)	25 (18.0)	
Peripheral	16 (88.9)	114 (82.0)	
Video-assisted thoracoscopic surgery	16 (88.9)	95 (68.3)	0.098
Open thoracotomy	2 (11.1)	44 (31.7)	
Procedure			0.267
Wedge resection	1 (5.6)	12 (8.6)	
Segmentectomy	2 (11.1)	4 (2.9)	
Lobectomy	13 (72.2)	114 (82.0)	
Bilobectomy	2 (11.1)	8 (5.8)	
Pneumonectomy	0	1 (0.7)	
Mediastinal LNs			0.444
No evaluation	1 (5.6)	23 (16.5)	
Sampling	1 (5.6)	16 (11.5)	
Dissection	16 (88.9)	100 (71.9)	
Pleural adhesion			0.691
None	11 (61.1)	93 (66.9)	
Partial	4 (22.2)	31 (22.3)	
Total	3 (16.7)	15 (10.8)	
Tumor size (cm)	3.1±1.0	3.0±1.0	0.744

Table 2. Continued

Characteristic	Octogenarians (n=18)	Age 50–70 yr (n=139)	p-value
Histology			0.088
Adenocarcinoma	13 (72.2)	106 (76.3)	
Squamous cell carcinoma	5 (27.8)	33 (23.7)	
Differentiation			0.771
Well	5 (31.3)	167 (52.5)	
Moderate	7 (43.8)	130 (40.9)	
Poor	4 (25.0)	21 (6.6)	
No.of dissected LNs	13.8±12.6	12.6±8.5	0.580
Visceral pleural invasion	9 (50.0)	80 (57.6)	0.617
Lymphatic invasion	10 (55.6)	56 (40.3)	0.310
Vascular invasion	5 (27.8)	22 (15.8)	0.200
Adjuvant treatment	0	22 (15.8)	0.078
Chemotherapy		18	
Radiotherapy		4	
Concurrent chemoradiotherapy		0	

Values are presented as median±standard deviation or number (%).
LN, lymph node.
[a)]Eastern Cooperative Oncology Group performance status.

years (range, 0–10.3 years). Among patients with stage IA lung cancer, the median age of the octogenarians (n=16) was 81.9±3.1 years, and that of the younger group (n=318) was 61.2±5.5 years. There was no significant difference in most patient characteristics, except for a higher SUVmax (6.7 versus 3.5, p=0.004), poorer histologic differentiation (25.0% versus 6.6%, p=0.021), and smaller number of dissected LNs (6.4 versus 10.7, p=0.031) in octogenarians than in younger patients.

The percentage of sublobar resections was significantly higher in octogenarians than in younger patients (56.3% versus 18.9%, p=0.005). A comparison of the clinicopathological characteristics between the age groups of patients with stage IA NSCLC is shown in Table 1.

Among the patients with stage IB lung cancer, the median age of the octogenarians (n=18) was 82.3±2.1 years, and that of younger group (n=139) was 62.6±5.5 years. There was no significant difference in any of the characteristics between the 2 groups. A comparison of the clinicopathological characteristics between the age groups of patients with stage IB NSCLC is shown in Table 2.

2) In-hospital surgical outcomes

Among the patients with stage IA lung cancer, no in-hospital mortality was observed in either group. There was no significant difference in the complication rates between the 2 groups (31.3% versus 26.1%, p=0.771). Among the octogenarians, a respiratory complication occurred in 1 patient, and no neurologic complications were observed. The incidence of prolonged air leakage (for more than 7 days) was 25.0%.

Among the patients with stage IB lung cancer, there were no significant differences in the in-hospital mortality (0% versus 2.2%, p=1.0), hospital stay (12.9 versus 9.8 days, p=0.43), or complication rate (38.9% versus 31.7%) between the octogenarians and younger patients. No in-hospital mortality was observed among octogenarians with stage IA or IB lung cancer. The surgical outcomes of octogenarians and younger patients are presented in Table 3.

3) Survival results

Among the patients with stage IA lung cancer, 5-year recurrence-free survival was not significantly different between the octogenarians (n=16) and younger patients (n=318) (86.2% versus 89.1%, p=0.548). However, 5-year overall survival was significantly lower in octogenarians than in younger patients (79.4% versus 93.4%, p=0.009) (Fig. 1).

Among the patients with stage IB lung cancer, there was no significant difference in 5-year recurrence-free survival (62.1% versus 73.5%, p=0.55) or overall survival (77.0% versus 85.0%, p=0.75) be-

Table 3. Surgical outcomes by age group

Variable	Octogenarians (n=16)	Age 50–70 yr (n=318)	p-value
Stage IA			
No. of patients	16	318	
Chest tube duration (day)	5.6±3.8	5.2±4.4	0.726
Postoperative hospital stay (day)	9.2±4.1	8.8±9.7	0.869
Complications	5 (31.3)	83 (26.1)	0.771
Prolonged air leak	4 (25.0)	73 (23.0)	
Arrhythmia	0	1 (0.3)	
Edema or effusion	1 (6.3)	2 (0.6)	
Chylothorax	0	2 (0.6)	
Neurologic complications	0	2 (0.6)	
Pneumonia	0	2 (0.6)	
Bleeding	0	1 (0.3)	
In-hospital mortality	0	0	
Stage IB			
No. of patients	18	139	
Chest tube duration (day)	6.4±4.6	5.9±4.9	0.643
Postoperative hospital stay (day)	12.9±16.1	9.8±8.7	0.432
Complications	7 (38.9)	44 (31.7)	0.596
Prolonged air leak	6 (33.3)	36 (25.9)	
Arrhythmia	0	1 (0.7)	
Edema or effusion	0	2 (1.4)	
Chylothorax	0	1 (0.7)	
Neurologic complications	1 (5.6)	4 (2.9)	
Pneumonia	-	-	
Bleeding	-	-	
In-hospital mortality	0	3 (2.2%)	1.000

Values are presented as median±standard deviation or number (%).

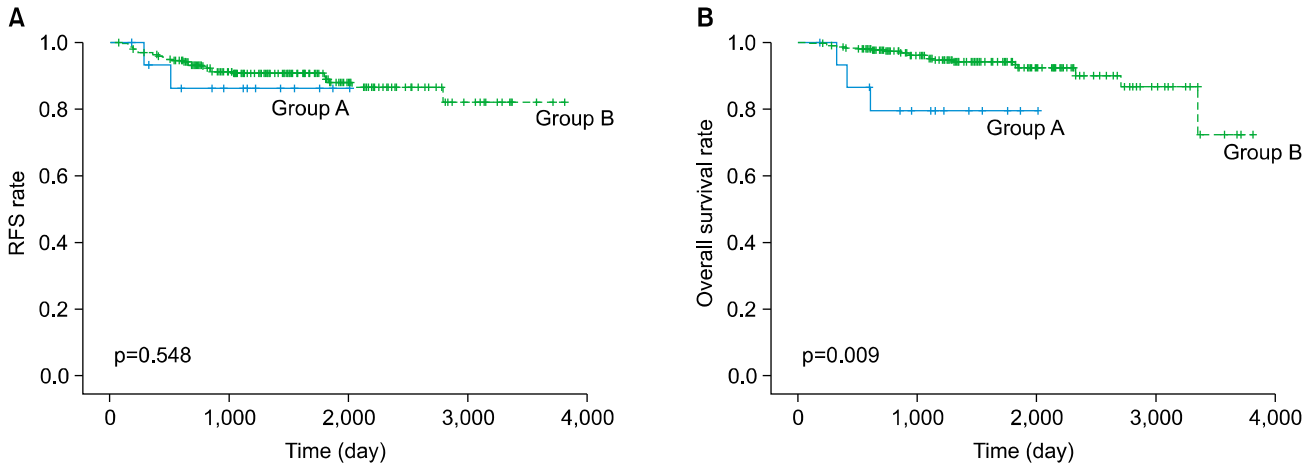

Fig. 1. Comparisons of the 5-year RFS rate (A) and the 5-year overall survival rate (B) of stage IA non-small cell lung cancer between group A (age ≥80 years) and group B (age 50–70 years). Group A: 5-year RFS, 86.2%; overall survival, 79.4%. Group B: 5-year RFS, 89.1%; overall survival, 93.4%. RFS, recurrence-free survival.

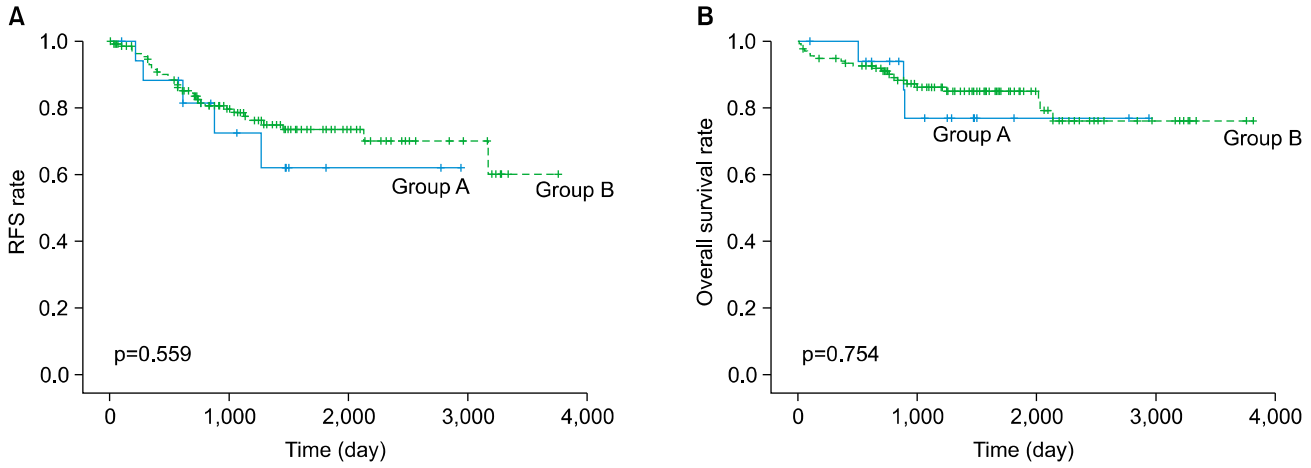

Fig. 2. Comparisons of 5-year RFS rate (A) and 5-year overall survival rate (B) of stage IB non-small cell lung cancer between group A (age ≥80 years) and group B (age 50–70 years). Group A: 5-year RFS, 62.1%; 5-year overall survival, 77.0%. Group B: 5-year RFS, 73.5%; 5-year overall survival, 85.0%. RFS, recurrence-free survival.

tween octogenarians (n=18) and younger patients (n=139) (Fig. 2). The recurrence data are summarized in Table 4.

Of the 34 octogenarians with stage I lung cancer who underwent pulmonary resection during follow-up, 6 died. Five of these deaths were cancer-related. One patient whose death was not associated with cancer died of pneumonia 11 months postoperatively, and the remaining patients died of recurrence and cancer progression after 1 year of survival.

In the multivariate analysis, the independent prognostic factors for overall survival after the pulmonary resection of stage I NSCLC included male sex (hazard ratio [HR], 5.795; p=0.017), number of dissected LNs (HR, 0.346; p=0.025), and tumor size (HR, 1.699; p=0.035). The prognostic factors for overall survival are summarized in Table 5.

Table 4. Summary of recurrence

Variable	Octogenarians	Age 50–70 yr	p-value
Stage IA			
No. of patients	16	318	
Overall recurrence	3 (18.7)	32 (10.0)	0.199
Locoregional recurrence	1 (6.3)	15 (4.7)	
Distant	1 (6.3)	12 (3.8)	
Both	1 (6.3)	5 (1.6)	
Stage IB			
No. of patients	18	139	
Overall recurrence	5 (27.7)	32 (23.0)	0.581
Locoregional recurrence	2 (11.1)	11 (7.9)	
Distant	1 (5.6)	14 (10.1)	
Both	2 (11.1)	7 (5.0)	

Values are presented as number (%). Locoregional recurrence was defined as recurrence within the ipsilateral hemithorax, including the pleura and mediastinal lymph nodes.

Discussion

Elderly lung cancer patients generally have multiple comorbidities, especially cardiopulmonary disorders, which make them high-risk groups for surgery. However, it is not ideal to include old age as a contraindication for surgical treatment of lung cancer, because physical ability varies substantially among individuals in each age group [6].

In this study, we compared patients aged less than 70 years and those aged 80 years or older, excluding those aged 70 to 80 years in order to compare the effects of old age with a younger age group more clearly. Most stage I lung cancer patients who undergo surgery at the present time are in their late 70s. We therefore concluded that comparing outcomes according to age in all patients with stage I lung cancer would most likely not be effective because including patients in their late 70s would lead to a relatively small age difference for a comparison with patients older than 80 years. Lung cancer patients under the age of 50 were not included because there were fewer than 10 such patients.

Table 5. Factors impacting the overall survival of stage I non-mall cell lung cancer by univariate and multivariate analysis

Variable	Hazard ratio (95% confidence interval)	p-value
Univariate analysis		
Age (yr)	1.046 (0.010–1.083)	0.011
Male sex	6.588 (2.793–15.537)	<0.001
Former or current smoker	4.415 (2.358–8.264)	<0.001
Other cancer history	1.636 (0.907–2.950)	0.102
CEA level (ng/mL)	1.044 (1.026–1.063)	<0.001
SUVmax	1.146 (1.095–1.199)	<0.001
FEV1 (%)	0.974 (0.957–0.991)	0.003
DLCO (%)	0.977 (0.962–0.992)	0.002
Central location	1.597 (0.744–3.432)	0.230
Sublobar resection	1.799 (0.929–3.484)	0.082
Mediastinal LNs		0.028
No evaluation	1	
Sampling	0.780 (0.347–1.752)	0.547
Dissection	0.424 (0.222–0.808)	0.009
Adjuvant chemotherapy	1.823 (0.717–4.635)	0.207
Tumor size (cm)	1.551 (1.187–2.026)	0.001
Differentiation		<0.001
Well	1	
Moderate	3.486 (1.642–7.401)	0.001
Poor	5.649 (2.288–13.949)	<0.001
Histotype (squamous cell carcinoma)	3.235 (1.780–5.877)	<0.001
Number of dissected LNs	0.977 (0.941–1.016)	0.242
Visceral pleural invasion	2.011 (1.057–3.826)	0.033
Lymphatic invasion	3.249 (1.813–5.820)	<0.001
Vascular invasion	3.301 (1.587–6.867)	0.001
Postoperative complications	3.751 (2.090–6.733)	<0.001
Multivariate analysis		
Age(yr)	1.036 (0.986–1.089)	0.163
Male sex	5.895 (1.377–25.230)	0.017
Former or current smoker	1.857 (0.776–4.443)	0.165
CEA level (ng/mL)	1.016 (0.988–1.046)	0.262
SUVmax	1.069 (0.956–1.195)	0.241
FEV1 (%)	0.999 (0.974–1.024)	0.947
DLCO (%)	0.985 (0.964–1.007)	0.169
Sublobar resection	1.742 (0.582–5.214)	0.321
Mediastinal LNs		0.065
No evaluation	1	
Sampling	0.397 (0.124–1.269)	0.119
Dissection	0.346 (0.136–0.878)	0.025
Tumor size (cm)	1.699 (1.037–2.784)	0.035
Differentiation		0.931
Well	1	
Moderate	1.071 (0.333–3.447)	0.908
Poor	0.880 (0.223–3.477)	0.856
Histotype (squamous cell carcinoma)	0.800 (0.257–2.494)	0.701
Visceral pleural invasion	1.529 (0.617–3.786)	0.359
Lymphatic invasion	1.278 (0.485–3.369)	0.620
Vascular invasion	1.744 (0.551–5.523)	0.344
Postoperative complications	2.249 (0.998–5.067)	0.051

CEA, carcinoembryonic antigen; SUVmax, maximum standardized uptake value; FEV1, forced expiratory volume in 1 second; DLCO, diffusing capacity for carbon monoxide; LN, lymph node.

In this study, we compared outcomes according to age based on a classification of patients into those with stage IA disease and those with stage IB disease. Stages IA and IB are known to have different prognoses, as has been shown in various studies. In this study, the prognosis of patients with stage IB disease was poorer. However, in our study data, the distribution of octogenarian patients was 4.8% in the stage IA group and 11.4% in the stage IB group. To reduce the bias caused by differences in stage, the outcomes were compared for each stage separately.

In this study, octogenarians with stage IA lung cancer had a higher sublobar resection rate and fewer dissected LNs than the younger group. This may have been due to concerns that elderly patients could experience greater morbidity from extended pulmonary resection and LN dissection.

Dell'Amore et al. [7] and Okami et al. [8] reported that octogenarians with stage I lung cancer with multiple comorbidities could be treated with sublobar resection, with equivalent in-hospital mortality and long-term survival compared with lobar resection, but with less postoperative morbidity.

Mizuguchi et al. [9] suggested that lung resection should be performed without complete mediastinal LN dissection in octogenarians since mediastinal LN dissection has little effect on long-term survival and poses the risk of worsening a patient's performance status at discharge. Okami et al. [10] suggested dissection of mediastinal LN was an independent risk factor for postoperative complications.

In our study, there was no in-hospital mortality among octogenarians after the resection of stage IA lung cancer, and there was no significant difference in the incidence of major complications as compared with younger patients. The above results seem reasonable, as only octogenarian patients with a low

Eastern Cooperative Oncology Group performance status grade and good pulmonary function were selected to undergo surgery.

In the recent, several authors have demonstrated acceptable results in terms of in-hospital mortality and long term prognosis after pulmonary resection in octogenarians. In 2007, Dominguez-Ventura et al. [11] reported an operative mortality rate of 6.3% in 379 octogenarians who underwent pulmonary resection for early lung cancer. A French nationwide review demonstrated a 30-day mortality rate of 6.5% in 622 patients aged >80 years [12]. In 2011, Fanucchi et al. [13] reported a postoperative mortality rate of 2.4% in 82 patients aged >80 years.

In our study, recurrence-free survival in stage IA lung cancer was not different between the 2 groups, but overall survival was lower in octogenarians than in younger patients. A lower 5-year survival rate in octogenarians is expected because these patients have a lower life expectancy than younger patients. In addition, higher cancer-related survival after complete resection of stage IA lung cancer may have contributed to the overall survival difference between the 2 groups.

Among patients with stage IB lung cancer, there were no significant differences in any characteristics between the 2 groups, and there was no difference in the sublobar resection rate or the number of LNs dissected. Despite the high potential for morbidity, the standard procedure was also performed in octogenarians to achieve appropriate oncological outcomes. Nevertheless, it was also confirmed that the complication rate and in-hospital mortality rate of octogenarians were low, with no significant difference from the younger group. The octogenarians who underwent surgery in this study showed good pulmonary function and relatively few comorbidities. The aggressive selection of surgical patients may have influenced the good surgical outcomes. Among patients with stage IB lung cancer, overall survival and recurrence-free survival were not significantly different between the 2 groups.

In the multivariable analysis, male sex, number of dissected LNs, and tumor size were factors related to survival (HR, 5.795; p=0.017; HR, 0.346; p=0.025; and HR, 1.699; p=0.035, respectively). Age, type of resection, and adjuvant treatment were not risk factors for overall survival. In the multivariable analysis of overall survival, we did not distinguish between stage IA and IB because we included the tumor size and visceral pleura invasion, which are the criteria for IA and IB in the AJCC TNM seventh edition staging system.

Some limitations to this study must be acknowledged. First, it was a retrospective study. Second, octogenarians who underwent surgery were selected more carefully in terms of preoperative morbidity and performance status. In addition, the number of octogenarians was smaller than that of the younger patients.

In conclusion, surgical outcomes and recurrence-free survival after pulmonary resection for stage I lung cancer were comparable in octogenarians and younger patients. Older age is therefore not a contraindication to surgical resection for NSCLC.

The postoperative mortality rate has continuously improved, so surgical treatment can be considered as a safe option for elderly patients with early-stage lung cancer. However, thorough preoperative work-up and selection are important for safe and satisfactory results. The role of surgery in elderly patients with advanced-stage lung cancer remains unclear, and further studies are certainly needed.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

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