

Lung Cancer Surgery in Nonagenarians

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We report two cases of lung cancer in nonagenarians successfully treated by pulmonary resection and assess the feasibility of surgical treatment in such an old population. Case 1. An asymptomatic 93-year-old man was diagnosed as having non-small cell lung cancer with clinical T1N0M0 stage IA disease, and a right upper lobectomy was performed via video-assisted thoracoscopic surgery. Mediastinal dissection was omitted. He was discharged on postoperative day 16, and he remains well without recurrence 6 months after the operation. Case 2. A 92-year-old man was diagnosed as having non-small cell lung cancer with clinical T2N0M0 stage IB disease and diminished pulmonary function. A right lower lobectomy with complicated partial resection of the diaphragm was performed via axillary thoracotomy with thoracoscopic support. He was discharged on postoperative day 28 and is well 42 months after the surgery. Although the feasibility of pulmonary resection in a nonagenarian could not be confirmed from only these two cases, pulmonary resection is a possible treatment option for lung cancer in selected nonagenarians. (Ann Thorac Cardiovasc Surg 2008; 14: 314–318)

Key words: aged, complication, lung cancer, nonagenarian, surgery

Introduction

As the proportion of elderly people in developed countries increases, the morbidity and mortality as a result of lung cancer in these populations is also rapidly increasing. Especially in Japan, where the proportion of elderly people is increasing rapidly compared with other countries, an explosive increase in lung cancer is predicted in the forthcoming highly aged society. Lung cancer surgery in nonagenarians is also predicted to increase, but there are few reports of this in such elderly patients in the literature. We report two cases of lung

cancer in nonagenarians successfully treated with pulmonary resection and discuss the characteristics of surgical treatment in this older population.

Case 1

An asymptomatic 93-year-old man with a 13-year history of mild aortic regurgitation and atrial fibrillation was referred to our institute with an abnormal lung shadow on a routine chest X-ray at a regional hospital. A bronchoscopic biopsy showed adenocarcinoma, and the lesion was diagnosed as a primary lung cancer. Physical examination revealed good systemic health and performance status 1, though he had osteoarthritis of the knees. Chest X-ray on admission revealed an irregularly shaped speculated lung mass approximately 2 cm in diameter in the right upper lung field (Fig. 1A). Chest computed tomography (CT) demonstrated the same irregular lesion in the periphery of the posterior segment of the right upper lobe (Fig. 1B). No hilar or mediastinal lymph node swelling was demonstrated.

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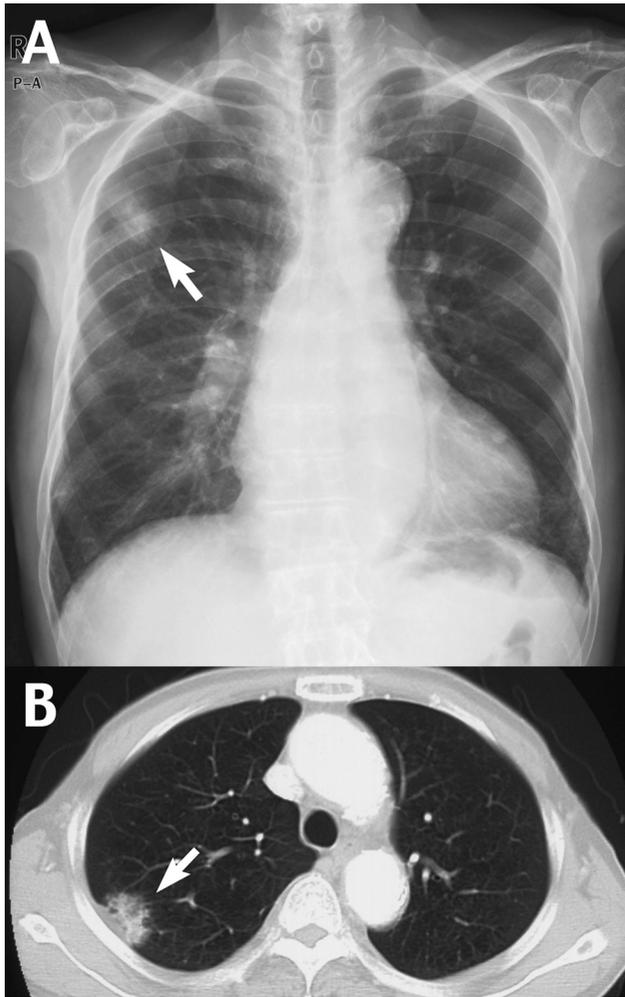


Fig. 1.
A: Chest X-ray demonstrating an irregularly shaped, speculated lung mass approximately 2 cm in diameter in the upper lung field (arrow).
B: Chest computed tomography demonstrating the same irregular lesion with a mild pleural indentation in the periphery of the posterior segment of the upper lobe (arrow).

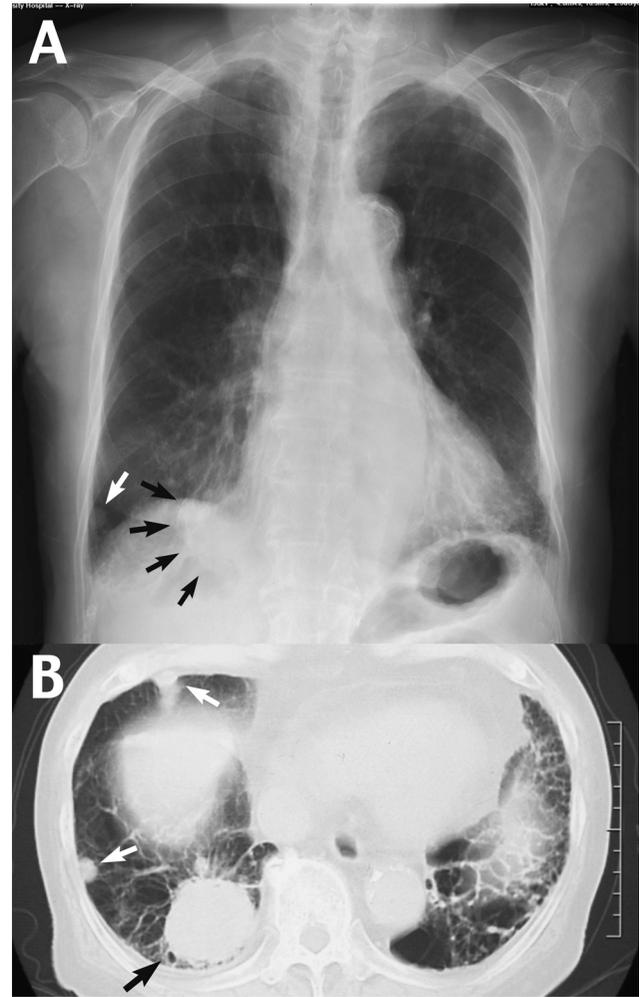


Fig. 2.
A: Chest X-ray revealing a round lung mass approximately 4 cm in diameter beyond the right diaphragmatic dome (black arrows). Small nodular lesions are also visualized in the lower lung field (white arrow).
B: Chest computed tomography demonstrating a mass 4 cm in diameter in the posterior basal segment of the right lung (black arrow). Two other well-demarcated mass lesions are also demonstrated in the periphery; these are suspected to be old tubercular lesions (white arrows).

Bone scan and CT of the brain and abdomen revealed no metastatic lesions. Electrocardiography showed atrial fibrillation, voltage criteria of the left ventricular hypertrophy, nonspecific intraventricular conduction delay, and poor R wave progression. Cardiac ultrasonography demonstrated well-preserved heart function with an ejection fraction of 50% and mild aortic valve regurgitation. Pulmonary function tests revealed that the vital capacity, percent of vital capacity, forced expiratory volume/1 sec, forced expiratory volume 1%, functional residual capacity, and percent of diffusion capacity for carbon monoxide were 3.17 L, 112.4%, 1.47

L, 47.57%, 2.67 L, and 98.1%, respectively. Arterial blood gas analysis revealed that the arterial carbon dioxide and oxygen tensions were 44.0 and 74.6 torr, respectively. Serum biochemistry was normal apart from a creatinine level of 1.32 mg/dL (normal <1.10). The glomerular filtration rate was 29%. We diagnosed clinical T1N0M0 stage IA disease, with slightly diminished heart, lung, and renal function. In accordance with the patient's wishes, we decided to undertake surgical treatment for his lung disease.

A right upper lobectomy was performed via video-assisted thoracoscopic surgery (VATS). Mediastinal dissection was omitted to minimize surgical invasiveness. The connective tissue was more fragile than in octogenarians. Postoperative air leakage from the pulmonary fistula was prolonged and needed chemical pleurodesis 7 days after the operation. Serum creatinine was temporarily elevated to 1.81 mg/dL, but was quickly returned to the preoperative level without treatment. The postoperative course was otherwise unremarkable, and he was discharged on postoperative day 16. Histopathology confirmed a well-differentiated adenocarcinoma without nodal extension, and he was diagnosed with T1N0M0 stage IA disease. He remains well without worsening systemic health or recurrent disease 6 months after the lung surgery.

Case 2

A 91-year-old man with a history of hypertension and pulmonary emphysema presented to a nearby clinic with multiple lung shadows. Routine follow-up with chest X-ray and CT showed that one of the lung masses had increased in diameter to 4.8 cm, from 2.5 cm, whereas the size and shape of the other nodules had not. He was referred to our institute at age 92, one year after the lung shadows were first discovered. A bronchoscopic biopsy showed squamous cell carcinoma. A physical examination revealed good systemic health and performance status 1. His chest X-ray on admission revealed a round mass approximately 4 cm in diameter in the right lower lung field beyond the diaphragmatic dome (Fig. 2A). Chest CT demonstrated a 4 cm diameter mass in the posterior basal segment of the right lung and a diffuse low attenuation area in both lung fields (Fig. 2B). Two other well-demarcated masses were revealed adjacent to the parietal pleura of the right lower lobe; they were suspected to be old tubercular lesions. No effusion or hilar or mediastinal lymph node swelling was demonstrated. Bone scan and CT of the brain and abdomen revealed no metastatic disease. Electrocardiography showed normal sinus rhythm. Cardiac ultrasonography demonstrated good left ventricular function with an ejection fraction of 56%. Pulmonary function tests revealed that the vital capacity, percent of vital capacity, forced expiratory volume/1 sec, forced expiratory volume 1%, functional residual capacity, and percent of diffusion capacity were 2.46 L, 94.3%, 1.45 L, 61.7%, 2.37 L, and 102.3%, respectively. Arterial

carbon dioxide and oxygen tensions were 36.7 and 73 torr, respectively. Serum biochemistry was normal except for a creatinine level of 1.18 mg/dL (normal <1.10). Glomerular filtration rate was not measured. We made a diagnosis of clinical T2N0M0 and stage IB disease with slightly diminished pulmonary function. In accordance with the patient's wishes, we decided to undertake surgical treatment for the lung disease.

A right lower lobectomy was performed via axillary thoracotomy with thoracoscopic support. There were severe pleural adhesions, probably a result of previous subclinical tubercular pleuritis. Because the tumor involved the diaphragm, we also undertook combined partial resection of the invaded part. Mediastinal dissection was omitted. The serum creatinine level was elevated postoperatively to 2.40 mg/dL, but returned to the preoperative level after infusion therapy. Dyspnea on effort increased postoperatively, and the arterial oxygen tension decreased to 69 torr. His chest tube was removed on postoperative day 14, and he was discharged on postoperative day 28 without home oxygen therapy. Histopathology confirmed a moderately differentiated squamous cell carcinoma with hilar nodal involvement, and he was diagnosed with T3N1M0 stage IIIA disease. The other lung nodules were confirmed to be caseous granuloma. He received no adjuvant therapies. Twenty-three months after the operation, recurrent disease was detected as a nodular lesion 1.5 cm in diameter in the lingula of the left lung. This lesion was successfully treated by percutaneous radiofrequency ablation (RFA) therapy under CT guidance. He remains well without worsening systemic health or further recurrent disease 42 months after the lung surgery.

Discussion

Japan has one of the world's fastest aging societies. Life expectancy at birth is 78.5 years for men and 85.5 years for women.¹⁾ The proportion of elderly people is also increasing in other developed countries. Mortality resulting from lung cancer is increasing as the population ages in these developed countries, especially in Japan, and is predicted to increase rapidly. Furthermore, the development of less invasive surgical methods such as VATS has advanced lung cancer surgery in the elderly in the past decade. Because of these trends, we assume that the number of cases of lung cancer treated by surgical resection will also increase.

The criteria for surgical treatment in nonagenarians

Table 1. Morbidity and mortality following lung cancer surgery in octogenarians reported in the literature in the past decade

Researchers	Nation	Investigation period	N	Lobectomy or more (%)	Mean age (y.o.)	Morbidity (%)	Mortality (%)
Hope et al. (2007) ²⁾	United States	1999–2004	20	12 (60)	82	45	10
Dominguez-Ventura et al. (2006) ⁴⁾	United States	1985–2004	379	272 (72)	82	48	6.3
Mizuguchi et al. (2006) ³⁾	Japan	1990–2003	40	32 (80)	82	68	0
Muraoka et al. (2005) ⁵⁾	Japan	1985–2001	33	10 (30)	82	30	0
Brock et al. (2004) ⁶⁾	United States	1980–2002	68	52 (76)	82	44	8.8
Port et al. (2004) ¹³⁾	United States	1990–2003	61	50 (82)	82	38	1.6
Aoki et al. (2003) ⁷⁾	Japan	1985–2001	49	49 (100)	81	20	2
Aoki et al. (2000) ⁸⁾	Japan	1981–1998	35	25 (71)	81	60	0
Tanita et al. (1999) ⁹⁾	Japan	1983–1997	24	24 (100)	NS	58	0
Hanagiri et al. (1999) ¹⁰⁾	Japan	1992–1995	18	12 (67)	82	50	0
Pagni et al. (1997) ¹¹⁾	United States	1980–1995	54	48 (89)	82	42	3.7
Naunheim et al. (1994) ¹⁴⁾	Switzerland	1981–1991	37	31 (84)	83	45	16
Osaki et al. (1994) ¹²⁾	Japan	1974–1991	33	25 (76)	82	56	3

NS, not stated.

are still unknown, but they should basically be similar to the criteria for octogenarians. Some series undertaking surgical treatment for lung cancer in octogenarians have been reported and validated during the past decade.^{2–14)} The morbidity and mortality rates of each report are shown in Table 1. Of the 13 reports, 7 are from Japan. These results have been used to form a consensus regarding pulmonary resection in octogenarians as a feasible and important treatment option for lung cancer. The oldest patient in the literature who underwent pulmonary resection was 95 years old.⁴⁾

We have previously reported the results of surgical treatment in octogenarians with lung cancer.³⁾ In the previous report, we mentioned that complete mediastinal dissection significantly reduces postoperative performance status in octogenarians and increases the risk of postoperative complications. Several other reports have assumed that mediastinal dissection is an important factor for postoperative complications, especially cardiopulmonary complications.^{5,7,9)} Because of the high mortality rate after lung cancer surgery in the elderly, as shown in Table 1, postoperative complications should be minimized. If performance status or the ability to perform activities of daily life is reduced postoperatively, elderly patients can easily become bedridden. We therefore consider the omission of mediastinal dissection to be a reasonable surgical strategy in nonagenarians with lung cancer.

RFA is a recently introduced alternative and less invasive treatment option for lung cancer. The most suitable indication is for functionally inoperative patients such as those with poor tolerance or with high

risk for invasive surgery, as we have reported.¹⁵⁾ By using this new method, a greater number of the octogenarian and nonagenarian patients with lung cancer can be curatively treated, especially if combined with VATS. Further advances in less invasive surgical procedures are expected for the forthcoming highly aged society.

In conclusion, although the feasibility of pulmonary resection in nonagenarians could not be confirmed by only these two cases, pulmonary resection is a possible treatment option for lung cancer in selected nonagenarians. When performance status and pulmonary function have been well preserved preoperatively as presented cases, lobectomy with the omission of mediastinal dissection is considered to be a safe and appropriate method, satisfying both curability and low morbidity, to prevent postoperative complications and worsening systemic health even in nonagenarians.

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