

Long-term Survivors after Pulmonary Resection for Bronchogenic Carcinoma

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SUMMARY: Surgical resection is the most useful modality of treatment for patients with lung cancer. However, two third of the patients who underwent pulmonary resection died within 5 years after operation due to recurrent diseases. This study reviewed long-term survivors (more than 10 years after lung resection) and examined the factors relating to prognosis and the quality of life of the patients after 10 years.

Two-hundred and forty-nine patients underwent pulmonary resections for bronchogenic carcinoma in the First Department of Surgery of Nagasaki University Hospital between 1955 and 1978. Among 237 who tolerated operations, 32 patients (13.5%) survived more than 10 years after pulmonary resections. There were 23 men and 9 women. Among the patients with stage I, 25/85 (29.4%) survived more than 10 years, while in the cases with Stage III, only 3/122 (2%) survived. There was no difference with survival rate between the patients with squamous cell carcinoma and those with adenocarcinoma. Thirty patients underwent lobectomy and only two with pneumonectomy survived more than 10 years after surgery. Among 32 patients, 21 are alive and well without recurrence, 3 died of secondary primary lung cancer, one died of recurrent disease, and one died of gastric cancer. Most of the patients were free of respiratory symptoms after 10 years.

The favorable factors contributing to long-term survival after pulmonary resection for the patients with lung cancer are small and early lesions (Stage I, T₁, N₀, N₁), lobectomy, cell types of squamous cell carcinoma or adenocarcinoma, and ages under 70 years. However, secondary lung tumors would occur to the patients who survived more than 10 years after pulmonary resection, thus requiring continuous follow-up.

INTRODUCTION

The prognostic factors of the patients after surgery for lung cancer would be the size of tumor, the extent of lymph node involvement or cell type¹⁾²⁾³⁾. For the long-term survival, however, no lymph node metastasis, small tumor size or non-small cell carcinoma are related. Improved accuracy of staging system, perio-

perative management of the patients and understanding and complete mediastinal node dissection, contributed to the good results of surgery of the lung cancer patients. There were several reports dealt with the patients survived more than 10 years after surgery⁴⁾⁵⁾⁶⁾⁷⁾⁸⁾⁹⁾¹⁰⁾. In our study, we examined the factors relating to long term survival after operations and the quality of life of those after 10 years and discussed some problems associated with

long-term survival.

MATERIALS AND METHODS

During the periods from 1955 through December 1978, two hundreds and forty-nine patients underwent lung resection for bronchogenic carcinoma in the First Department of Surgery, Nagasaki University Hospital. Twelve patients (4.8%) died within 30 days after operation and were excluded from this study. The operative procedures performed were segmentectomy in 2 patients, lobectomy in 165 (70%), bilobectomy in 34 and pneumonectomy in 36 (15%) (**Table 1**). Thirty-two patients survived more than 10 years after lung resection.

Table 1. Pulmonary resection for bronchogenic carcinoma (1955-1978)

Operative procedure	No. of patients	Operative death	No. of patients involved
Segmentectomy	2	0	2
Lobectomy	170	5	165
Bilobectomy	35	1	34
Pneumonectomy	42	6	36
Total	249	12	237

RESULTS

Of the 10-year survivors, 23 were men and 9 were women. The ages ranged from 39 to 67 years. The 10-years survival rate of male

patients was 13% and that of female was 15%. The 10 year survival rate of the patients under 40 years of age were 14%, those between 40 and 49, 17%, those between 50 and 59, 15% and those between 60 and 69, 13%. The patients over 70 years of age did not survive more than 10 years after operation (**Table 2**).

Thirteen cases were classified histologically as squamous cell carcinoma and 13 were classified as adenocarcinoma, 4, large cell carcinoma and 2, others. The 10-year survival rate of the patients with squamous cell carcinoma was 15%, those with adenocarcinoma, 13% those with large cell carcinoma, 15%. There were no patients with small cell carcinoma survived more than 10 years (**Table 3**).

The 10-year survival rate of the patients with Stage I was 30%, those with Stage II, 14% and those with Stage III, only 2.5% respectively.

The 10-year survival rates of the patients who did not have lymphatic spread were 25% (26% in squamous cell carcinoma, 24% in adenocarcinoma and 27% in large cell carcinoma). Those of the patients with hilar node involvement were 16% and those of mediastinal node metastasis, only 2% (**Table 4**).

The 10-year survival rate of the patients with lobectomy was 17%, while those with bilobectomy, 6% and those with pneumonectomy, 6%. None of 2 patients who underwent pneumonectomy died with recurrent lung cancer (**Table 5**).

Twenty-eight of 32 patients underwent cura-

Table 2. Ten-year survivors : Age and sex (%)

Age (years)	~39	40~49	50~59	60~69	70~	Total
Male	1/2 (50.0)	6/35 (17.1)	9/59 (15.2)	7/65 (10.8)	0/16	23/177 (13.0)
Female	0/5	2/13 (15.4)	2/16 (12.5)	5/25 (20.0)	0/1	9/60 (15.0)
Total	1/7 (14.3)	8/48 (16.7)	11/75 (14.7)	12/90 (13.3)	0/17	32/237 (13.5)

Table 3. Ten-year survivors : Cell type and stage (%)

Cell type	stage I	stage II	stage III	stage IV	Total
Squamous cell ca.	9/33 (27.3)	1/9 (11.1)	2/41 (4.9)	1/3 (33.3)	13/86 (15.1)
Adenocarcinoma	11/38 (28.9)	1/7 (14.3)	1/52 (1.9)	0/5 (0)	13/102 (12.7)
Large cell ca.	3/9 (33.3)	1/3 (33.3)	0/14 (0)	0/1 (0)	4/27 (14.8)
Small cell ca.	0/1 (0)	0/2 (0)	0/7 (0)		0/10 (0)
Others	2/4 (50.0)		0/8 (0)		2/12 (16.7)
Total	25/85 (29.4)	3/21 (14.3)	3/122 (2.5)	1/9 (11.1)	32/237 (13.5)

Table 4. Ten-year survivors : Lymph node involvement and cell type (%)

Cell type	N ₀	N ₁	N ₂	N ₃	Total
Squamous cell ca.	10/39 (25.6)	2/15 (13.3)	1/29 (3.4)	0/ 3 (0)	13/ 86 (15.1)
Adenocarcinoma	10/42 (23.8)	2/14 (14.3)	1/41 (2.4)	0/ 5 (0)	13/102 (12.7)
Large cell ca.	3/11 (27.3)	1/ 6 (16.7)	0/14 (0)	0/ 1 (0)	4/ 27 (14.8)
Small cell ca.	0/ 1 (0)	0/ 3 (0)	0/ 7 (0)	0/ 1 (0)	0/ 10 (0)
Others	2/ 7 (28.6)		0/ 8 (0)	0/ 1 (0)	2/ 12 (16.7)
Total	25/100 (25.0)	5/38 (13.2)	2/89 (2.2)	0/10 (0)	32/237 (13.5)

Table 5. Ten-year survivors : Operative procedure and curability (%)

Procedure	Curative	Relative curative	Non-curative	Total
Segmentectomy		0/ 2 (0)		0/ 2 (0)
Lobectomy	24/ 81 (29.6)	3/54 (5.6)	1/30 (0)	28/165 (17.0)
Bilobectomy	2/ 10 (20.0)	0/14 (0)	0/10 (0)	2/ 34 (5.9)
Pneumonectomy	2/ 10 (20.0)	0/15 (0)	0/11 (0)	2/ 36 (5.6)
Total	28/101(27.7)	3/85 (3.5)	1/51 (2.0)	32/237 (13.5)

Table 6. Ten-year survivors : Causes of death

Prognosis		No. of patients	Cause of death	
alive	cancer (—)	21		
	cancer (+)	0		
dead	cancer (+)	5	lung cancer (primary)	3
			lung cancer (metastatic)	1
			gastric cancer	1
			cerebral embolism	1
			cerebral bleeding	1
			Esophageal varix	1
			renal failure	1
	cancer (—)	6	unknown	2

tive operations. However, only 4% of the patients with relative curative operations survived more than 10 years. One of the 51 patients with non-curative operation, who had ipsilateral solitary lung metastasis at thoracotomy, survived 17 years after left lower lobectomy.

Eleven patients died between 11 and 19 years after operation. The causes of death were lung cancer in 4 patients, gastric cancer in one, cerebral diseases in 2, rupture of esophageal varix in one, renal failure in one and unknown in two.

Twenty-one of the 32 10 year survivors are alive from 10 years through 20 after operation at this writing. At present, the ages range from 52 years old and 82. They are free of recurrence of lung cancer and spend daily life without difficulty.

Table 7. Prognosis of the patients survived more than 10 years after lung resection for bronchogenic carcinoma.

Survival (yr)	No. of patients	Still alive	Dead
10-14	23	15	8
15-19	8	5	3
20-	1	1	0

DISCUSSION

Primary lung cancer is considered as one of the malignant tumors with the poor prognosis and cured only by surgical treatment. With regards to increasing numbers of resected cases with lung cancer, several reports have appeared concerning about long-term survivors more than 10 years. In the literatures, 10-year survival rates

were 18% in Watson⁴⁾, 18% in Ashor⁶⁾, 12% in Shields⁹⁾ and 20% in Sørensen¹⁰⁾. There were no differences among those reports about 10-year survival rates. Our 10-year survival rate of the resected cases for lung cancer was 14%, almost the same to the previous reports.

There were many reports which mentioned about various factors relating to the prognosis after lung resection for bronchogenic carcinoma. However, different results were reported because of different materials. The most important factor related to survival is the extent of regional lymph nodes metastasis. The patients with no hilar or mediastinal lymph node metastasis usually survive longer. Contrarily the patients with mediastinal lymph node involvement have grave prognosis.

In our patients, 10-year survival rates of the cases without lymph node metastasis were 25%, but, those with mediastinal lymph node metastasis were only 2.2%. There were statistically significant difference between them.

There were some controversies whether the histologic type of lung cancer influences the prognosis after surgery. It is clear that the patients with small cell carcinoma have poor prognosis. Higgins¹⁾, Kirsh¹¹⁾, and Stevenson¹²⁾ reported that postoperative survival rate of the patients with squamous cell carcinoma is better than those of adenocarcinoma or large cell carcinoma. On the other hand, Shields²⁾, Paulson⁷⁾ and Vincent⁸⁾ described that there were no difference of postoperative survival rates among cell types. However, Shields²⁾ presented that in the cases with mediastinal lymph node metastasis, the survival rate of the patients with squamous cell carcinoma was better than those with other cell types. We observed that there were no difference in survival among cell types except for small cell carcinoma.

With regard to the influence of tumor size to prognosis, Yashar²⁾ and Tarkka¹³⁾ stated that the smaller the size was, the better the prognosis was (those cases with less than 2cm had 61% of 5-year survival rate, whereas those with more than 4.5cm had only 4.3%). However, Shields²⁾ reported that the size of the tumor did not influence the survival rate of the patients after evaluating multi-factor analysis.

Then, how about the operative procedures?

Yasher³⁾, Brock⁵⁾, Shields⁹⁾, and Sørensen¹⁰⁾ reported that there were no differences in survival after surgery between lobectomy and pneumonectomy. However, there were several reports that the survival rates with lobectomy were better than those of pneumonectomy. Ten-year survival rates of the patients with lobectomy and pneumonectomy were 20% and 8% in Vincent's report⁸⁾, 22% and 8% in Paulson's⁷⁾ and 28% and 12.8% in Ashors'⁶⁾. Kirsh reported that in the squamous cell carcinoma, lobectomy had better 10-year survival rate than pneumonectomy and in the patient with adenocarcinoma or undifferentiated carcinoma, there were no long-term survivors of pneumonectomy patients. He stated that operative indication should be strictly evaluated.

In our cases, the patients with lobectomy had better prognosis than those with pneumonectomy. However, our cases with pneumonectomy had often central and mediastinal node metastasis.

The other factors contributing to prognosis were reported as age, associated pulmonary diseases such as chronic emphysema, location of tumor and positive margin of resected bronchus.

The quality of life of the patients who survived more than 10 years after operation was relatively well. They have spent almost normal daily life without difficulty and no respiratory symptoms. The reason why our patients had little respiratory problem is that they underwent lobectomy. In the literatures, the patients with pneumonectomy had handicap compared with those with lobectomy 10 years after surgery. Watson⁴⁾ and Valente¹⁵⁾ reported that the patients with pneumonectomy had more or less pulmonary hypertension due to overinflation of the residual opposite lung and had a tendency of later death.

One of the problems when the patients survived more than 10 years after lung resection is the relatively high frequency of secondary cancers⁴⁾. Not only the secondary lung cancer but also cancers in other organs such as gastric cancer may occur in the patients. Therefore, long-term follow up is necessary to detect such secondary cancers.

In conclusion, long-term survival can be

achieved in the patients who underwent lung resection for bronchogenic carcinoma. The favorite factors contributing to long-term survival of the patients with lung cancer are small and early lesions (Stage I, T1, N0 or N1), ages under 70 year, lobectomy with curative operation, cell types with non-small cell carcinoma. However, secondary lung tumors might occur in the patients survived more than 10 years after pulmonary resection. Therefore continuous follow-up is necessary.

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