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Clinical Outcome of Double Lobectomy for Metachronous Double Primary Lung Carcinoma

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Abstract：Pulmonary lobectomy is performed as the radical operation for primary lung carcinoma. It is controversial, however, whether patients with second primary lung carcinoma who have undergone an initial lobectomy should also undergo lobectomy.[1)2)] We therefore retrospectively investigated the outcomes of double lobectomy for metachronous double primary lung carcinoma. From January 1998 to August 2008, we performed double lobectomy in 11 patients, 10 men and 1 woman, with metachronous double primary lung carcinoma. The patients' age at first lobectomy ranged from 48 to 79 years (mean 64.8 years), and that at second lobectomy ranged from 57 to 80 years (mean 69.3 years). The average follow-up duration was 4.4 years after the first lobectomy, and the average duration between the first and second lobectomy was 3.1 years. Eight patients were still alive, and three patients were dead after the second lobectomy at the time of the investigation. Two of three dead patients died of respiratory failure, and one died of cancer. Twenty two lung subsegments in total for double lobectomy including right lower lobectomy were resected for both dead patients with respiratory failure. A second lobectomy is appropriate as a clinical strategy for patients with metachronous primary lung carcinoma who have undergone another lobectomy. However, if right lower lobectomy is included in the double lobectomy, postoperative respiratory failure should be considered.

Key words：**Double Lobectomy, Metachronous Lung Carcinoma, Right Lower Lobectomy, Respiratory Failure**

Introduction

For multiple pulmonary carcinomas, it has been reported that an aggressive surgical approach is safe and warranted in most patients, but that is sometimes not so good.[2)] There have been some reports regarding second surgical treatments for patients with metachronous lung cancers, but there have been few referring to double lobectomy for metachronous double primary lung carcinoma.[1)–6)] Over the last 10 years, we have 11 patients undergoing metachronous double lobectomy for metachronous double primary lung carcinoma. We investigated the clinical outcomes of those patients to evaluate the appropriateness and risks of the double lobectomy.

Patients and Methods

From January 1998 to August 2008, 19 patients underwent two lung resections for metachronous double primary lung carcinoma in our institution. Among 19 patients, a second lobectomy was performed in 11 patients who had previously undergone another lobectomy. The approaches to ana-

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tomical lobectomy in those patients were posterolateral muscle-sparing thoracotomy or a video-assisted thoracoscopic approach. Each surgeon chose the approach, but each lobectomy was successfully performed in our usual manner. We investigated the anatomic locations of the first and second primary lung carcinoma, histology, stage classification, preoperative VC, preoperative FEV1, predicted postoperative VC, resected number of subsegments in total, postoperative complications, and prognosis. We then reviewed the relation between those parameters and prognosis. Predicted postoperative VC is calculated by the following numerical formula (Fig. 1).

(Predicted postoperative VC) = (Preoperative VC at second lobectomy) × (Total number of subsegments to remain after double lobectomy) / (Total number of subsegments before the second lobectomy)

In addition, it was pathologically diagnosed that those carcinomas were metachronous double primary carcinomas by our expert pathologists, according to the criteria proposed by Martini and Melamed in1975.[7)]

Results

The 11 patients undergoing second lobectomy included 10 men and 1 woman. The age range was 48 to 79 years with a mean age of 64.8 years at the first lobectomy. At the second lobectomy, the patients' age ranged from 57 to 80 years, and the mean age was 69.3 years. Tumor histology was adenocarcinoma in 13 lobes and squamous cell carci-

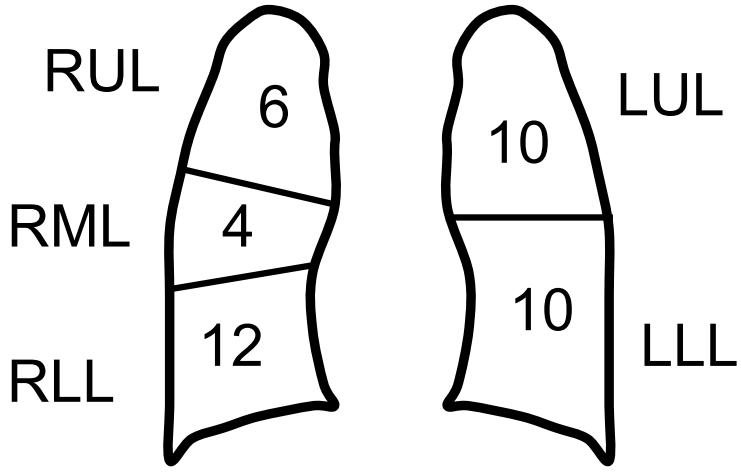


Fig. 1 The number of subsegments in each lobe
RUL:right upper lobe, RML:right middle lobe, RLL:right lower lobe, LUL : left upper lobe, LLL : left lower lobe

Table. 1 Patients' characteristic, histology, stage classification, and tumor location

Case	Age	Gender	Histology	TNM	Location of carcinoma	Prognosis
1	64/67	M	Sq/Sq	IB/IB	RUL/LUL	Dead
2	48/57	M	Ad/Sq	IB/IB	LUL/RUML	Alive
3	79/80	M	Sq/Sq	IIIA/IA	LUL/RUL	Alive
4	61/64	M	Sq/Ad	IIB/IIIA	LUL/RUL	Alive
5	63/66	F	Ad/Ad	IA/IA	RUL/LLL	Alive
6	65/66	M	Ad/Ad	IB/IB	RLL/LLL	Dead
7	68/71	M	Sq/Ad	IIA/IB	LUL/RLL	Dead
8	62/64	M	Sq/Ad	IIIA/IA	LUL/RLL	Alive
9	70/79	M	Ad/Ad	IIB/IB	RUL/LUL	Alive
10	74/74	M	Ad/Ad	IIA/IA	RUL/LUL	Alive
11	75/75	M	Sq/Ad	IIB/IA	LLL/RUL	Alive

1st op/2nd op
RUL : right upper lobe, RUML : right upper and middle lobe, RLL : right lower lobe, LUL : left upper lobe, LLL : left lower lobe

noma in 9 lobes, and the clinical stages of cancer were from IA to IIIA (Table 1). Preoperative %VC at the first lobectomy ranged from 71.1% to 125.6%, and the mean was 95.7%. The preoperative %VC at the second lobectomy ranged from 57.4% to 118.1%, and the mean was 80.4%. Preoperative FEV1 ranged from 1,500 ml to 2,920 ml with a mean of 2,201 ml, and preoperative % FEV1 ranged from 42.9% to 85.1% with a mean of 63.5% at first lobectomy. At the second lobectomy, preoperative FEV1 ranged from 1,410 ml to 2,570 ml with a mean of 1,895 ml, and preoperative %FEV1 ranged from 39.3% to 74.9% with a mean of 55.7% (Table 2). The anatomic locations of the first and second primary lung carcinoma are showed in Table 3. The number of resected subsegments, for which the number was 42 in total in both whole lungs, ranged from 16 to 22 with a mean of 17.8. Postoperative complications occurred in 4 patients: ARDS in 2, pneumonia in 1, and chronic renal failure in 1. One of 3 dead patients (case 1) died of cancer, and the other 2 patients (case 6 and 7) died of postoperative respiratory failure. Both dead patients with postoperative respiratory failure underwent lobectomy of the right lower lobe, which has the largest number of subsegments. One of the two patients (case 7) died of acute respiratory failure on the 22nd postoperative day (Fig. 2). After the second lobectomy, 8 patients were alive and 3 patients were dead at the time of our investigation. The survival duration after the second lobectomy ranged from 22 to 1639 days with a mean of 469.5 days. The duration between the first and second lobectomies ranged from 133 days to 3514 days with a mean of 1124.0 days. The total survival duration from the first operation ranged from 248 days to 4012 days with a mean of 1593.5 days (Table 3).

Table 2 Patients' preoperative lung function and predicted VC after second lobectomy

Case	VC (ml)	%VC (%)	FEV1 (ml)	%FEV1 (%)
1	4,310/2,890 (2,230)	125.6/84.2	2,920/2,570	85.1/74.9
2	3,200/2,800 (2,016)	92.1/80.6	2,400/2,010	69.0/60.7
3	3,500/2,730 (2,238)	106.3/82.9	2,260/2,050	68.7/62.3
4	2,860/2,310 (1,932)	71.1/57.4	1,980/1,580	49.2/39.3
5	2,810/2,790 (2,008)	118.9/118.1	1,990/1,810	84.2/76.6
6	3,180/2,380 (1,650)	86.7/65.2	2,440/2,030	66.5/55.4
7	3,660/2,330 (1,514)	78.5/69.3	2,410/1,500	52.0/44.6
8	3,880/3,440 (2,236)	97.2/86.2	2,400/1,920	60.1/48.1
9	3,170/3,090 (2,225)	92.6/90.3	2,180/1,740	63.7/53.8
10	3,020/2,640 (1,901)	87.4/76.4	1,500/1,410	43.4/40.8
11	3,450/2,660 (2,154)	96.1/74.1	2,390/2,030	66.6/55.7

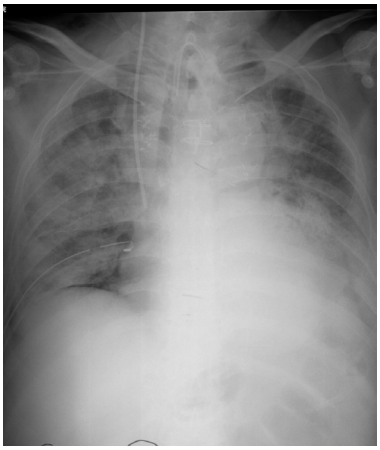
1st op/2nd op (Predicted Postoperative)

Table 3 Total number of resected subsegments, survival time, and complications

Case	Number of resected subsegments	Duration of between 1st and 2nd op. (day)	Survival time after 2nd op. (day)	Complications
1	16	1052	313	—
2	18	2210	1639	ARDS
3	16	133	205	Pneumonia
4	16	1227	256	—
5	16	959	1139	—
6	22	338	273	—
7	22	2182	22	ARDS
8	22	402	585	—
9	16	3414	498	—
10	16	207	129	—
11	16	140	108	—

1st op/2nd op (Predicted Postoperative)
ARDS: adult respiratory distress syndrome

Before second lobectomy



After second lobectomy (day 22)

Discussion

What kind of surgical procedure should be performed for patients with metachronous primary lung carcinoma who have previously undergone lobectomy? The surgical options for second metachronous carcinomas depend on the extent of the disease, the initial surgical procedure, and the patient's pulmonary reserve.[2)8)] For example, if the lung carcinoma are small and located in the periphery, or if the patient is high risk, segmentectomy or wedge resection might be considered. But if the patient is not high risk or if the tumor is not a small peripheral nodule, lobectomy is logically considered as a radical treatment. However, no obvious rule has been formulated.

Adebonojo and colleagues have reported that the operative morbidity and mortality are acceptable and long–term survival is possible in many patients with metachronous lung cancer, but in general, limited resection is favored for a second peripheral cancer 3). It was reported by Yano et al that 31% of patients who underwent double lobectomy died of respiratory failure, which was the most frequent cause of death 1). If there were some parameters to predict a prognosis after second lobectomy, we could be careful about postoperative complications, especially for respiratory failure.

High mortality has been reported for patients who have undergone lobectomy following a contralaretal lobectomy in the literature 1). In our experience, two patients died of respiratory failure. In comparing those two patients with the other nine patients, we found some differences in terms of the following three factors: the combination of two resected lobes, the total number of lost subsegments, and predicted VC after second lobectomy. In the two resected lobes of the two patients who died, the right lower lobe was included. The right lower lobe, with its 12 subsegments, has the largest number of subsegments. A total of 22 subsegments is the largest number in a combination of two lobes that we can resect. We had three patients who underwent double lobectomy and lost 22 subsegments because of right lower lobectomy, 2 of whom were the patients with respiratory failure who died, as has already been mentioned. Then when right lower lobectomy is included in the double lobectomy, we have to be concerned about postoperative respiratory failure, because the remaining lung volume is quite small. We think that right lower lobectomy should be a risk factor in double lobectomy.

However, what caused the difference in outcomes between the one living patient and the two who died? We supposed that this difference was the absolute value of VC. The predicted postoperative VC of the one living patient (case 8) was 2,232 ml; on the other hand, those of the two dead patients (case 6 and 7) were 1,650 ml and 1,514 ml,

respectively. These results suggest that if the predicted postoperative VC is below 2,000 ml, we should watch carefully for signs of postoperative respiratory failure. It is needless to say that we must continue this study and attempt to further confirm this speculation because the number of cases examined in the present study was small. Furthermore we must investigate the other predictors that might be related to the postoperative respiratory failure, but at this time we are making an effort to resolve those issues in the future.

In our investigation, it was revealed that right lower lobectomy and predicted postoperative VC could be predictors of postoperative respiratory failure in double lobectomy. A second lobectomy is feasible as a surgical treatment for metachronous second primary lung carcinoma, but we should pay close attention to postoperative respiratory failure if right lower lobectomy is included in the double lobectomy.

Conclusion

Right lower lobectomy could be a risk factor of postoperative respiratory failure in double lobectomy for patients with metachronous double primary lung carcinoma.

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