

An Investigation of Early Death Following the Operation for Lung Cancer

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SUMMARY : In our clinic 212 patients with primary lung cancer had undergone lung resection during 12 years from April 1977 to March 1989. The authors reviewed 41 patients who died within a year after operation. Twenty-eight deaths were from cancer; 13 from other causes. We inquired, from the view-point of operative indication and postoperative measurement, what points should be paid attention to in order that the operation performed may indeed benefit the treatment for lung cancer. Conclusions are that the following measures are essential to take precaution against the early death after operation: (1) strict preoperative assessment of the stage of cancer; (2) avoiding reduction surgery-absolutely non-curative resection; (3) keeping the blood volume transfused during and after operation as minimum as possible; (4) preventing atelectasis immediately after operation; (5) and preventing postoperative aspiration and alimentary tract bleeding.

INTRODUCTION

Surgical approach to lung cancer has been increasingly accepted as a single means of its treatment, a means that is expected to provide a hope for its curability. We, however, have sometimes encountered death cases early in the postoperative period without fulfilling initial purpose. To improve the operative results, we conducted a retrospective clinical study on the patients who had undergone lung resections for lung cancer at our institute and died within a year after the operations.

SUBJECTS AND METHODS

Of 212 patients with primary lung cancer who had been operated on at our institute during 12 years from April 1977 to March 1989, 41 who

died within a year postoperatively — including operative death — were selected as subjects. Dividing them into the patients whose death originated from cancer and those whose death was caused by others than cancer, we examined the time of death, the age, staging of cancer, histological types, operative curability and causative factors in non-cancerous death.

RESULTS

During this period, 41 patients (19.3%), out of 212 who had undergone lung cancer resection, died within a year after the operations. Their age ranged from forties (2 patients) to fifties (6), sixties (17) seventies (15), and eighties (1). Stages of cancer varied from stage I (4 patients) to stage II (5), stage IIIa (20), stage IIIb (8), and stage IV (4). The group of cancerous deaths comprised 19 male patients and 9 female patients, with the

average age of 60.8; the group of non-cancerous death, 12 male patients and 1 female patient, with the average age of 68.6.

The time and cause of death are tabulated in **Table 1**. Five operative deaths occurred within a month postoperatively, including the following 3 patients with myocardial infarction: the one who, showing elevated ST segments on intraoperative ECG, developed ventricular fibrillation; the one, fatty woman, who seemed to have vasospastic angina as a cause and the one, an elderly patient with three-branch involvement, who died suddenly on the 10th postoperative day. The other two died of pneumonia induced by aspiration or pyothorax due to bronchial fistula after pneumonectomy. Among the hospital deaths, 2 were due to multiple organ failure caused by gastrointestinal bleeding, 3 due to pneumonia, 2 due to cerebral infarction, one due to pyothorax and 28 due to cancer advancement. The cancerous deaths in early time involved those with small cell carcinoma who had received left pneumonectomy after neoadjuvant therapy and developed multiple bone metastasis and those with Pncoast's cancer whose surgery had resulted in absolutely non-curative resection.

As regards to the type of operations, segmental resection was carried out in one patient, corresponding to 20% of total segmental resections out of 212 lung resections; lobectomy in 25.16% of total lobectomies; bilobectomy in 4, 28% of total bilobectomies; and pneumonectomy in 11, 30% of total pneumonectomies. For 7 patients, combined resections were performed such as the resection of the vena cava superior, left atrium, chest wall and whole pleura. Six of 9 patients who died from cancer within 6 months had received blood transfusion exceeding 2,000 ml during and after operation.

As in **Table 2**, 28 cancerous deaths showed the relation between the stage of cancer and the type of histological findings as follows: Four of 6 patients with stage I-II had low-differentiated adenocarcinoma. Eight of 12 with stage IIIa had adenocarcinoma too. Of 7 patients with stage IIIb, 4 had squamous cell carcinoma which had been treated with a combined resection. Each patient with stage IV died from distant

metastasis of large cell carcinoma having intrapulmonary metastasis, of small cell carcinoma and of adenosquamous carcinoma, respectively.

Relation between operative curability and sites of recurrence in 28 cancerous deaths are summarized in **Table 3**. Of 10 patients who died after curative resection, 5 patients who had undergone absolutely curative resection died from distant metastasis. Four of these 5 patients had T₂-factor. In 3 of them the

Table 1. Time and cause of death after resection for lung cancer

time	cancerous death	myocardial infarction	cerebral infarction	MOF	pneumonia	pyothorax	total
1M		3			1	1	5
3M	2			2	1		5
6M	7		1		1	1	10
	19		1		1		21
12M							
total	28	3	2	2	4	2	41

Table 2. Relation between stage and histological type in 28 cancerous death

Stage	Histological type					total
	Sq	Ad	Ad+Sq	Large	Small	
I	1	1				2
II		3	1			4
IIIa	2	8		1	1	12
IIIb	4	1	1	1		7
IV			1	1	1	3
total	7	13	3	3	2	28

Sq: squamous cell carcinoma Large: large cell carcinoma
Ad: adenocarcinoma
Ad+Sq: adeno-squamous carcinoma Small: small cell carcinoma

Table 3. Relation between operative curability and sites of recurrence in 28 cancerous death

curability	Parts of Recurrence						total
	local	brain	bone	liver	adrenal gl.	lung	
absolutely curative		3		1		1	5
relatively curative	2	1	2				5
relatively non-curative	3	2	1	1	1	1	9
absolutely non-curative	5	1	2	1			9
total	10	7	5	3	1	2	28

histological type of cancer were that of adenocarcinoma. Every patient, with symptoms arising from distant metastasis early postoperatively, died after being superimposed by physical weakness on account of severe operative stress and postoperative complication. Causes of death in 5 patients who had undergone relatively curative resection were as follows: 2 patients with stage IIIb died from either bone or brain metastasis after the operation combined with resection of superior vena cava; 2 patients with adenocarcinoma died from either brain metastasis or pleuritis carcinomatosa; and the other with large cell carcinoma died from pleuritis carcinomatosa after the operation combined with the chest wall resection. Those who had relatively non-curative resection were the patients whose operation went without radical mediastinal dissection. Among them the ratio of the deaths from local recurrence to those from distant metastasis was 1:2. Out of 9 deaths who had undergone absolutely non-curative resection, 5 died from local recurrence, 2 had received panpleuro-pneumonectomy, and 3 had the cancer mass which was obviously left unresected. The contributing factors of death from non-cancerous causes are listed. Two of 3 patients who died of myocardial infarction had diabetes mellitus and left ventricular hypertrophy. Smoking habits and arrhythmia were observed in all these patients. Two deaths from multiple organ failure had suffered from peptic ulcer. The causatives of pneumonia which killed patients postoperatively include the following: age over 70 in all patients; receiving pneumonectomy in 2; FEV 1.0% below 60% in 2; agranulocytosis due to side effects of postoperative chemotherapy in one. Two deaths from pyothorax were associated with bronchial fistula after pneumonectomy or long-lasting alveolar fistula.

DISCUSSION

The causative factors of death within a year after lung resection for lung cancer are roughly divided into two categories — the one including postoperative complications and the other with recurrence of cancer. The age of the patients died from cancer averaged 60.8, younger than

commonly supposed; 68.6 in the case of non-cancerous death.

Some reports say that the incidence of operative death, which is the outcome to be infallibly skirted, ranges from 1.7 to 2.6% in Japan¹⁾²⁾ and from 2.1 to 4.0% — relatively high — in the United States and Europe³⁾⁴⁾⁵⁾. In our institution, it was 2.3% (5 of 212 resections). We have occasionally encountered those patients who developed arrhythmia or proceeded to atrial fibrillation a few days later postoperatively. Among those, 3 out of 5 patients who died after operation were in the category of sudden death due to circulatory complications such as arrhythmia, elevated ST segments and the like — that is, death of myocardial infarction. Recently, some cases have been reported in which a coronary bypass operation preceded the lung cancer operation or in which a patient received a simultaneous operation for coronary disease and for lung cancer⁶⁾. Since the surgery for lung cancer has a tendency to be increasingly indicated in the future even for elderly patients with high risk, one should endeavor to thoroughly understand the pathology of suspectable angina pectoris by active employment of coronary angiography.

The death of pneumonia tends to decrease by virtue of the progress of postoperative management and the widespread use of bronchoscopic suction of secretions. However many of the elderly patients and heavily smoking patients still have difficulty in postoperative removal of airway secretions, so that it is warranted to pay much regard to airway toilet starting from the preoperative period. Aspiration pneumonia particularly, refractory to treat, necessitate out paying careful attention to the patients with recurrent nerve paralysis and those who need long-term indwelling intratracheal tubes at the time of oral intake. In two patients, multiple organ failure arised from alimentary tract bleeding causing renal failure which led to cardiac failure. For those who have a history of peptic ulcer — while it is indispensable to take H₂ blockers — preventive procedures for atelectasis should come first with suctioning the secretions and toileting the airway using a bronchoscope, because there is high possibility that postoperative hypoxia provokes alimentary

tract bleeding. This therapeutic policy seems to facilitate the prevention of circulatory complications, too. Concerning the type of operation, many of the patients who underwent pneumonectomy received the combined resection of adjacent structures. The incidence of death after pneumonectomy was higher than that after lobectomy, though it may be inadequate to compare it by the type of operation alone.

Among the cancerous deaths, many of them — 22 of 28 — showed the stage of IIIa or more. As for histology, the patients with adenocarcinoma counted many. Our grave reflexion relates to the fact that 5 patients who had received absolutely curative resections presented signs and symptoms of distant metastasis soon after operation, then rapidly deteriorated to death. They might have some latent metastasis — with factor M₁. Thus we fully realize how crucial it is to strictly assess the staging in the preoperative period. On the basis of the results of preoperative tests, including scintigraphy with various isotopes, CT, and ultrasonography, we have made it a rule to exclude the patient with factor M₁ from the operative subjects; however, differentiating the M₁ cases from the others has been nearly impossible on some occasions. Yamaoka *et al.*⁷⁾ determine the malignancy of lung cancer depending on the DNA ploidy pattern, the result of which we would like to expect as a useful guidance in the future. The group of the patients who died from cancer within a year after relatively curative resection included the patients who sustained relatively large operative stress. In 3 of 5 patients of this group, the total blood volume transfused in intra- to postoperative period exceeded 3000 ml. On the basis of data from 150 lung resections for lung cancer, Imaizumi *et al.*⁸⁾ state that, in the lobectomized patients, the prognosis of the patients with blood transfusion was significantly poorer than those without blood transfusion. We, therefore, speculate that compromised immunity postoperatively induced by massive blood transfusion also influence — as a contributing factor — cancer recurrence in the early postoperative period. Postoperative deaths from local recurrence were seen in 5 of 9 patients with

absolutely non-curative operation. There is no place for reduction surgery to take part in the treatment for lung cancer; that is, it seems mandatory, according to operation schedules elaborately prepared beforehand, to avoid such an operation as even part of the cancer mass would be otherwise left unresected. Two patients, with pleural dissemination, who had been subjected to panpleuropneumonectomy died within a year after operation. This operative technique remains still controversial; we are to cope with it judiciously hereafter.

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