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Completion pneumonectomy

A retrospective analysis of indications and results

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Abstract Between 1970 and 1993, 446 patients underwent pneumonectomy. Completion pneumonectomy was performed in 37 patients (8.3%): 34 men and 3 women, with a mean age of 61 years (range 20–78 years). Indications were benign disease in 4 patients and carcinoma in 33. Of the latter, 21 patients underwent resection for metachronous lung cancer, 6 for recurrent lung cancer, 4 for previous incomplete resection, 1 for primary lung cancer after previous resection for benign disease and 1 patient after previous segmentectomy for metastasis. The mean interval between first operation and completion pneumonectomy was 41 months (range 1–187 months) for the whole group, 30 months for benign disease and 42 months for carcinoma. The overall operative mortality was 6/37 (16.2%); 1/4 patients with benign disease and 5/33 (15.2%) patients with carcinoma. Nine patients (29%) had one or more major non-fatal complication. Actuarial 3- and 5-year survival rates were 41.0% and 24.5% for the entire group, 75% at both times for patients with benign disease, 36.4% and 18.3% for all patients with carcinoma at the time of completion pneumonectomy and 24.3% and 14.5% for patients with metachronous or recurrent lung cancer. For 15 patients with stage I or II metachronous lung cancer, the 3- and 5-year survival rates were 33.9% and 16.9%. All six patients with stage III metachronous cancer died within 18 months. In conclusion, completion pneumonectomy carries a high operative mortality and morbidity. Long-term survival is negatively influenced by stage III lung cancer. [Eur J Cardio-thorac Surg (1996) 10:238–241]

Key words Pneumonectomy · Completion pneumonectomy

Introduction

Pneumonectomy is a well known and frequently performed thoracic surgical procedure with a mortality rate of about 7% [2]. Only a few studies discussing the indications and results of completion pneumonectomy have appeared in the literature [3, 5, 8]. In this report we analyze the incidence, indications and results of 37 completion pneumonectomies.

Material and methods

Between 1970 and 1993, 1638 patients underwent lung resection of whom 446 underwent pneumonectomy, including completion pneumonectomy in 37 patients (8.3%). In the latter group 34 were men and 3 women, with a mean age of 61 years (range 20–78 years) at the time of completion pneumonectomy. The indication for the first resection was benign lung disease in 5 patients and lung cancer in 31 patients. In one patient the initial indication was metastasectomy (Table 1).

Of the five patients with benign lung disease, three underwent a single resection before completion pneumonectomy (one bilobecto-

my, one lobectomy and segmentectomy and one lobectomy and wedge resection). Two patients underwent more than one thoracotomy: one patient underwent segmentectomy initially, followed by completion lobectomy for bronchiectasis after 14 years. The other patient underwent segmentectomy for an open chest injury, followed by bilobectomy and a third thoracotomy for decortication because of empyema.

All 31 patients with lung cancer had a single initial resection. Ten patients underwent lobectomy on the left, and 14 on the right, side. Seven patients underwent bilobectomy of the right lower and middle lobe. There were no sleeve-resections in this group. Only two patients received postoperative radiation therapy. The single patient with pulmonary metastasis underwent three thoracotomies before left completion pneumonectomy: five wedge resections on the left side, followed by segmentectomy on the left side, followed by lobectomy on the right side.

Indications for completion pneumonectomy were benign disease in 4 patients and carcinoma in 33 patients, all staged according to the criteria of the New International Staging System for Lung Cancer [6]. In cases of carcinoma only those patients were considered for completion pneumonectomy who probably had no mediastinal lymph node invasion or distant metastasis. We routinely performed a computed tomography (CT) scan of the chest and upper abdomen and a technetium bone scan since they were available. We performed a mediastinoscopy in all patients who had not undergone this procedure before. There were no repeat mediastinoscopies in this series. Since we used a CT scan, patients with suspected extensive lymph node involvement and a previous mediastinoscopy were excluded from operation. Pulmonary function was assessed by arterial blood gas samples, spirometry and, in some cases, perfusion scan. Arterial blood gases had to be normal at rest and after exercise. The expected forced expiratory volume in 1 s after the operation had to be more than 1 l. We did not perform pulmonary artery catheterization. The patients were declared fit enough to undergo a completion pneumonectomy.

Twenty-one patients underwent resection for metachronous lung cancer, using the criteria defined by Martini [4] (13 stage I, 2 stage II, 6 stage IIIa). Six patients underwent resection for recurrent lung cancer (1 stage II, 1 stage IIIa, 2 stage IIIb, 2 unknown), four patients for previous incomplete resection (2 stage I, 1 stage II, 1 stage IIIa), one patient for primary lung cancer (stage IIIb) after previous resection for tuberculosis and the last patient for metastasis (Table 2). Unexpected N2 node status, discovered during the operation, was not a contraindication for resection and complete ipsilateral mediastinal lymph node dissection.

The mean interval between first operation and completion pneumonectomy was 41 months (range 1–187 months) for the entire group, 30 months for patients with benign disease and 42 months for patients with carcinoma at the time of completion pneumonectomy.

The operation was performed through a standard posterolateral thoracotomy. In 1/3 of the patients a subperiostal rib resection was performed to get sufficient access. Because of dense adhesions, the pneumonectomy was extrapleural in 2/3 of the patients. We had to deal with large blood losses, especially after a previous extrapleural resection. In nearly all patients the hilum was avoided because of adhesions and the pulmonary vessels were ligated intrapericardially. However, in one patient the pericardial cavity was obliterated because of an intrapericardial initial resection and hilar dissection was impossible because of ligneous reaction due to lung abscess and empyema. The hilum was controlled by complete cross-clamping and oversewn by interrupted sutures. The lateral serratus muscle was transposed into the right pleural cavity to reinforce the bronchial stump and to reduce the pleural cavity. In all other patients, including the two patients irradiated after the first operation, we covered the bronchial stump either with viable surrounding tissues or with the pedicled pericardial fat pad.

Follow-up data at the end of this study were obtained from the referring pulmonary physician. Actuarial survival curves were calculated by the Kaplan-Meier method. Deaths from all causes were included.

Table 1 Indications for initial resection in 37 patients

Indication	No. of patients
Benign disease (5)	
Bronchiectasis	1
Aspergilloma	1
Tuberculosis	1
Traumatic	2
Lung cancer (31)	
Epidermoid carcinoma	24
Adenocarcinoma	5
Large cell carcinoma	1
Small cell carcinoma	1
Pulmonary metastasis (1)	
Adrenal gland carcinoma	1

Table 2 Indications for completion pneumonectomy in 37 patients

Initial resection	(*n*)	Completion pneumonectomy	No. of patients
Benign disease	5	Bronchiectasis	2
		Lung abscess	1
		Hemoptysis	1
		Primary lung cancer	1
Lung cancer	31	Metachronous cancer	21
		Local recurrence	6
		Incomplete previous resection	4
Metastasis	1	Metastasis	1

Results

The overall postoperative mortality was 6/37 (16.2%). Mortality for patients with benign disease was 1/4. This patient developed a bronchopleural fistula after completion pneumonectomy; the hilum had been controlled by complete cross-clamping and he died subsequently due to adult respiratory distress syndrome (ARDS). For patients with carcinomas the mortality rate was 5/33 (15.2%). Two patients died of ARDS, one of them having undergone a rethoracotomy because of hemorrhage. One patient died of respiratory insufficiency due to aspiration pneumonia and one patient died of cardiac insufficiency after myocardial infarction during the operation due to hemorrhage caused by a ruptured pulmonary vein. The last patient died of uncontrollable hemorrhage caused by left ventricular rupture due to cardiac herniation.

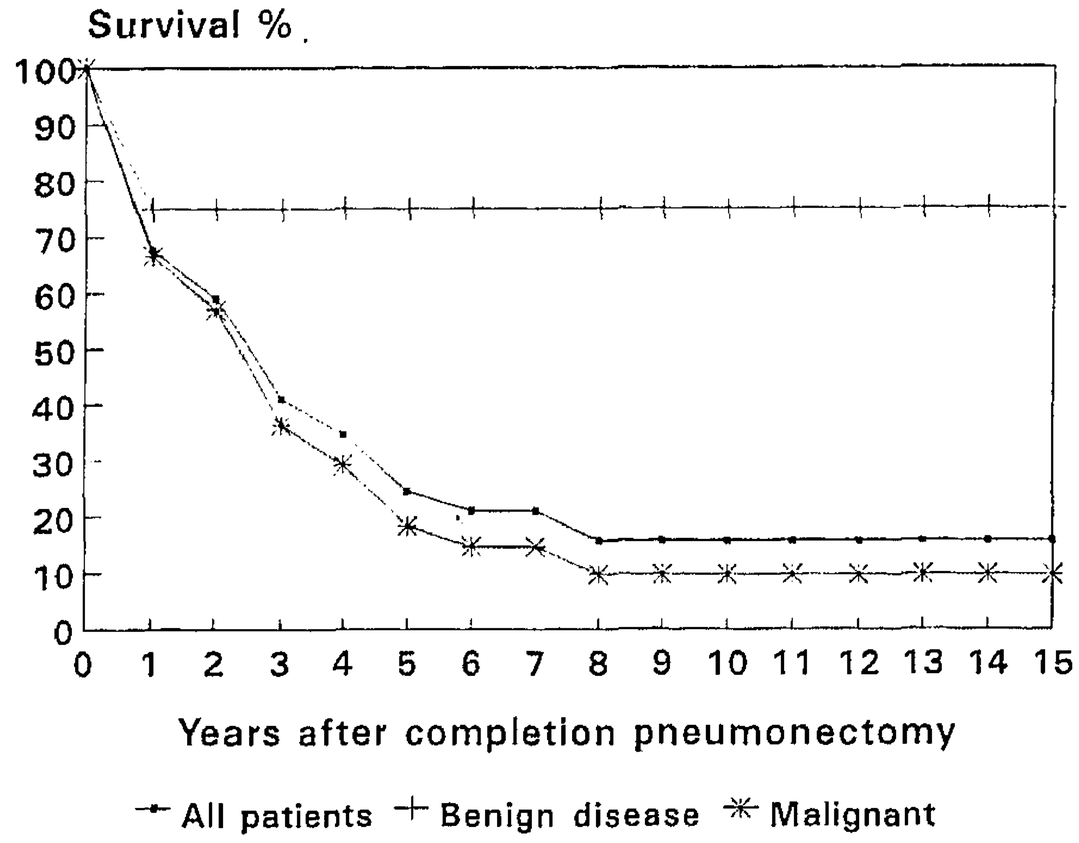

Fig. 1 Survival following completion pneumonectomy

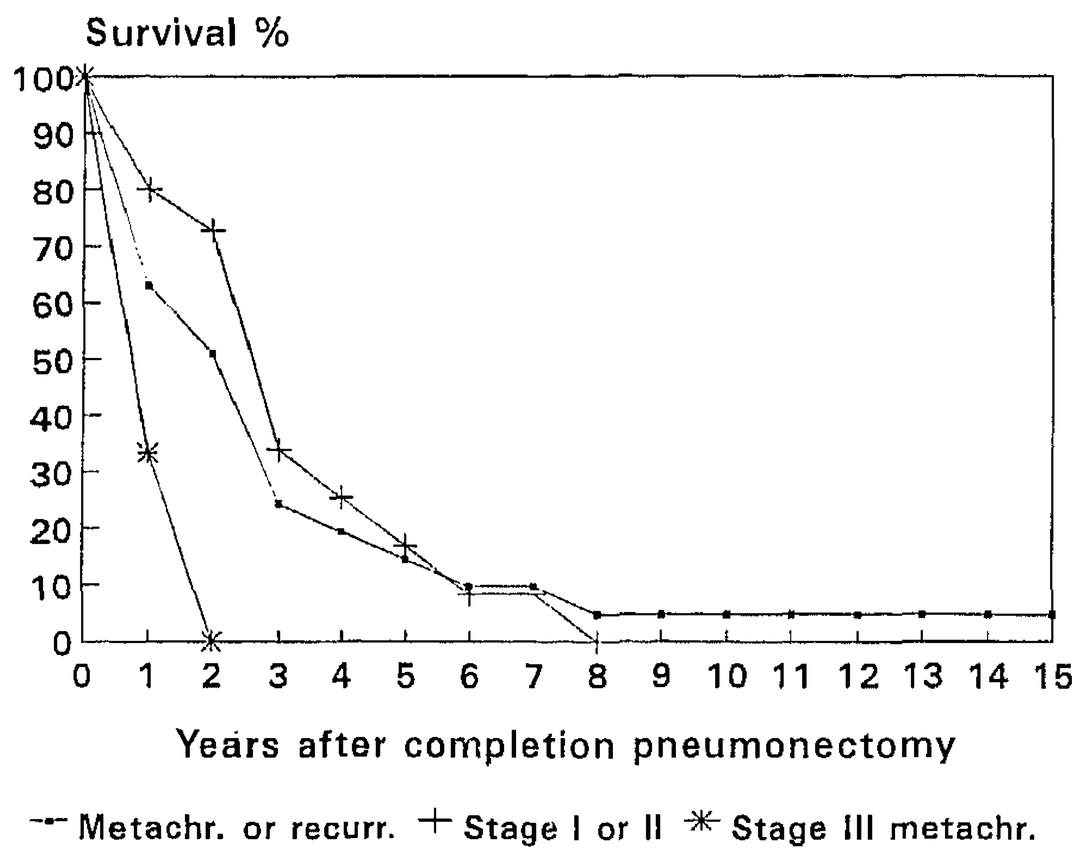

Fig. 2 Survival for metachronous or recurrent cancer

Nine patients (29%) had one or more major non-fatal complication during or after the operation: two patients had rupture of the pulmonary artery and two patients underwent rethoracotomy because of hemorrhage. 1 patient developed a bronchopleural fistula and empyema treated by thoracostomy and muscle flap closure of the fistula. Another patient developed an esophagopleural fistula and empyema, also managed by thoracostomy and a feeding gastrostomy. Two more patients developed empyema, one was treated by thoracostomy and the other by drainage-lavage. One patient was treated for bronchopneumonia. One patient presented ventricular fibrillation during the operation and was successfully defibrillated, four patients had atrial fibrillation after the operation with hemodynamic consequences despite digitalization.

The actuarial 3- and 5-year survival rates were 41.0% and 24.5% for the entire group, 75% at both times for patients with benign disease and 36.4% and 18.3% for all patients with carcinoma at the time of completion pneumonectomy (Fig. 1). For 27 patients with metachronous or recurrent lung cancer the 3- and 5-year survival rates were 24.3% and 14.5%, for 21 patients only with metachronous cancers 24.0% and 12.0%. For 15 patients with stage I or II metachronous lung cancer these rates were 33.9% and 16.9%. All six patients with stage III metachronous cancer died within 18 months (Fig. 2). The mean follow-up was 3 years and 7 months (range: 4 months–13 years and 5 months) and was complete for all 31 patients who survived completion pneumonectomy. At the end of this study three patients with benign disease and 6 of 28 patients with carcinoma were still alive, without evidence of any malignancy. Twenty-two patients died during follow-up: in 16 patients death was due to recurrent disease and/or metastasis. Two patients died because of respiratory insufficiency and two patients due to cardiac insufficiency. In two patients the cause of death was unknown.

Discussion

In our series the overall operative mortality was high (16.2%), more than twice the mortality rate of 6.2% for primary pneumonectomy reported by Ginsberg and the members of the Lung Cancer Study Group [2], but within the range of the participating hospitals (0%–25%). Mortality was higher for patients with benign disease (25%) then for patients with cancer (15.2%). McGovern et al. [5] reported an overall mortality rate of 12.4% in 113 patients undergoing completion pneumonectomy: the mortality for lung cancer ($n=64$) was 9.4%, for pulmonary metastases ($n=20$) 0% and for benign lung disease ($n=29$) 27.6%. In a series of 19 patients who underwent completion pneumonectomy after bronchial sleeve-resection Van Schil et al. [8] reported a mortality rate of 15.8%. Grégoire et al. [3] published an overall operative mortality of 10.0%; the mortality in 41 patients with lung cancer was 11.6% and in 19 patients with benign disease 5.9% for completion pneumonectomy.

In our series respiratory insufficiency and/or ARDS was a major cause of death. We used the same spirometric criteria as we did for primary pneumonectomy, but the gravity of the operative trauma and a more than normal need for transfusion were probably etiologic factors. Injury of great pulmonary vessels was a serious difficulty we encountered in three patients. It indicates that the ligneous reaction after the initial operation contributes to a raised operative risk, despite intrapericardial vessel control. When the pericardial cavity is obliterated, Deslauriers [1] suggests dividing the bronchus first and then ligating the

pulmonary vessels, which was impossible in one of our patients. Finally we found empyema to be a frequent complication after completion pneumonectomy, as has been reported by others, too [3, 5]. Utley [7] reported completion pneumonectomy and thoracoplasty, to obliterate the infected thoracic space and to achieve bronchial closure, in three patients with bronchopleural fistula and fungal empyema. Immediate thoracoplasty or muscle transposition might be a good option to prevent postpneumonectomy empyema, especially in infectious cases, despite the additive operative trauma.

During follow-up of the patients with benign disease no one died, but the 5-year survival rate for all patients with carcinoma at the time of completion pneumonectomy was 18.3% in our series. McGovern et al. [5] found a 5-year survival of 26.4% for all patients with lung cancer, despite 30 of 64 patients with stage III lung cancer, who still had a 5-year survival of 13.8%. In our series all six patients with stage III metachronous lung cancer died within 18 months.

In conclusion, completion pneumonectomy is a difficult operation with elevated postoperative morbidity and a high operative mortality. The patients seem to be at risk of developing ARDS and empyema. Nevertheless completion pneumonectomy offers a good prospect for long-term survival in patients with benign lung disease. In patients with lung carcinoma, long-term survival is negatively influenced by stage III lung cancer.

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