Surgical treatment of primary lung cancer and solitary brain metastasis

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ABSTRACT Twenty patients with carcinoma of the lung and a brain metastasis have undergone combined lung and brain surgery, which was synchronous in five. There were no operative deaths. Survival from the first surgical intervention was less than one year (3-10 months) in four patients (20%), one to two years in four (20%) and more than two years (26-66 months) in five patients (25%). Seven patients (35%) are alive and well after an average period of three years and three months (15-66 months). Actuarial survival at five years is 33.6%. All patients had severe neurological symptoms and 18 (90%) had a complete remission. Our experience and data reported in the literature point to the effectiveness of combined lung and brain surgery in prolonging symptom free survival in patients with lung cancer and solitary brain metastasis.

The survival of patients with lung cancer and brain metastasis is rather poor^{1,2} and seems not to be influenced by chemotherapy or radiotherapy, even from the point of view of the quality of life.³ The increasing evidence of encouraging results in published reports, and the possibility of a more accurate selection of patients with solitary brain metastasis by means of computed tomography, led us to consider combined surgical resection for lung cancer with brain metastasis.

This paper reports our seven year experience of 20 patients with special reference to length of survival and management of the neurological symptoms.

The patients

From January 1975 to December 1982 20 patients (17 men and three women, aged 33-63 years) among 773 who had thoracotomies for lung cancer (2.5%), underwent surgical resection of a primary lung cancer and an apparently solitary brain metastasis (table).

In five patients the first symptoms were neurological and a "brain neoplasm" was diagnosed clinically. A single brain lesion was resected and histological

examination showed a metastasis from lung cancer. The primary lung cancer was undetectable immediately after the neurosurgical resection by standard chest radiographs, tomography, cytological examination of sputum, bronchoscopy, perfusion lung scan, and gallium⁶⁷ whole body scan. The lung lesion was discovered, by chest radiographic follow up, from two to 36 (mean 15.4) months after brain surgery. Both scans were performed again before lung resection to exclude further metastases and to evaluate regional spread.

In five other patients, with neurological symptoms, lung cancer with solitary brain metastasis was diagnosed. Further metastases were excluded by liver, bone, and gallium whole body scans.

In 10 patients neurological symptoms appeared two to 39 (mean 13) months after surgery for lung cancer. A solitary brain metastasis was diagnosed by computed tomography. Further metastases were excluded by liver, bone, and gallium whole body scans.

The thoracic surgical procedure was a lobectomy in 15 patients, bilobectomy in one, pneumonectomy in two, and lobectomy with en bloc removal of chest wall in one. One patient had an exploratory thoracotomy (previous craniotomy) as the lung tumour could not be resected owing to massive mediastinal spread.

The neurosurgical procedure was based on complete removal (on the basis of macroscopic appear-

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Treatment, staging, and clinical outcome in 20 patients with lung cancer and solitary brain metastasis

Case No	Sex	Age (y)	First site of diagnosis	First site of treatment	Time between interventions (months)	T	N	Histology	Survival from first intervention (months)
1	F	63	B	B	26	2	2	Adenocarcinoma	38
2	F	50	B	B	2	2	1	Adenocarcinoma	3
3	M	55	B	B	36	2	2	Squamous cell	66*
4	M	54	B	B	5	2	2	Adenocarcinoma	42*
5	M	37	B	B	8	3	0	Undifferentiated	27
6	M	58	B L	B	1	2	1	Adenocarcinoma	12
7	M	39	B L	B	1	3	1	Undifferentiated	17
8	M	49	B L	B	1	2	0	Squamous cell	18
9	M	53	B L	B	1	2	2	Undifferentiated	13
10	M	61	B L	B	1	2	0	Alveolar cell	16*
11	M	33	L	L	7	3	1	Undifferentiated	10
12	M	56	L	L	17	2	0	Alveolar cell	26
13	F	39	L	L	39	2	1	Alveolar cell	66
14	M	54	L	L	2	2	0	Undifferentiated	9
15	M	50	L	L	13	2	1	Squamous	32
16	M	54	L	L	6	2	1	Undifferentiated	55*
17	M	55	L	L	14	2	0	Undifferentiated	42*
18	M	58	L	L	23	3	0	Undifferentiated	40*
19	M	40	L	L	4	2	2	Adenocarcinoma	5
20	M	52	L	L	5	3	0	Undifferentiated	15*

*Still alive.

B—brain; L—lung.

ances) of the brain metastasis by craniotomy. In each instance the histopathological report confirmed the pulmonary origin of the metastasis by showing that this was of the same cell type as the primary tumour.

Eight patients received adjuvant chemotherapy after surgery. Four patients were treated with chemotherapy and intrapleural BCG immunotherapy, and one patient received intrapleural BCG alone. Seven patients did not receive adjuvant treatment.

Results

There were no operative deaths but 13 patients have

Actuarial survival from first intervention of 20 patients with lung cancer and solitary brain metastasis.

died subsequently. Three patients (Nos 2, 11, and 19) did not derive any benefit from the combined surgical treatment and died within three months of the second intervention. Patients 11 and 19 are the only ones whose neurological symptoms were not relieved by brain surgery; the remaining 18 patients all had complete relief of neurological symptoms after brain surgery. Two patients (8 and 15) developed renewed neurological symptoms, 12 and 15 months respectively, after craniotomy. The remaining nine patients who died did not show recurrence of neurological symptoms and death was usually caused by intrathoracic recurrence of the disease.

Five patients (Nos 6, 7, 8, 9, and 14) survived from nine to 18 (mean 14) months from the first surgical intervention and from seven to 17 (mean 13) months from the second. Four of these patients were among the five whose lung tumour and brain metastasis were diagnosed at the same time.

Five patients (Nos 1, 5, 12, 13, and 15) lived longer than two years (26–66 (mean 38) months) from the first operation and 11–27 (mean 16) months from the second.

Seven patients (Nos 3, 4, 10, 16, 17, 18, and 20) are alive and free of symptoms 15–66 (mean 39) months from the first operation and 10–49 (mean 27) months from the second.

The figure shows the actuarial survival computed up to five years from the first surgical intervention. Survival at five years is estimated to be 33.6%.

The average survival of the 13 patients who died was 21 months, or 26 months if we exclude the three patients (2, 11, and 19) who did not show improve-

ment after the surgical resection, probably because of too advanced tumour spread. This points to the importance of accurate selection of patients in combined lung and brain surgery.

Discussion

The brain is highly susceptible to metastasis from cancer of the lung. In a large necropsy series Knights reported brain metastases in 55% of patients with lung cancer.⁴ Frequency of brain metastasis ranges in published reports from 14% to 79%, but most commonly is in the range 28–42%.^{5–11} Solitary brain metastases are reported in one third of the cases.^{6,7,12}

The average reported survival time of untreated patients with brain metastasis ranges from 1.5 to 6 months.^{1,2} Combined brain and lung surgery trials were prompted by the relative frequency of solitary brain metastases and the failure of radiotherapy and chemotherapy³ to prolong survival or even improve symptoms.

Operative mortality in previous series is from 3.6% to 44%.^{1,2,5,13,14} The one year survival rate after combined resections has ranged in previous trials from 1% to 30%.^{5,7,8,11,13,14} More recent surveys show a higher survival rate: 45% of patients alive after one year in Magilligan's series and 22% after two years in Salerno's series.^{1,2} Long term survival (up to 17 years) is reported.^{2,5,12,15–18}

Our results (no operative mortality and a 60% survival rate one year after the second surgical intervention) provide further support for the use of this procedure as a means of prolonging the patient's life and relieving many of the distressing and disabling symptoms. Our series, as well as others reported, shows that resection of the brain metastasis is the most effective way of obtaining prolonged remission of the neurological symptoms. Radiotherapy to the brain after resection of the brain metastasis is reported to have a beneficial effect in prolonging the symptom free period.^{1,2}

The better results in our series (even without irradiation of the brain) than in those previously published may be attributed to a better selection of patients for combined surgery. The use of computed tomography helps to identify patients who really have only a single intracranial metastasis and the

radionuclide investigations help to exclude distant metastases at other sites.

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