

THE MALIGNANT SOLITARY PULMONARY LESION

A FOLLOW-UP STUDY OF 117 SURGICALLY TREATED PATIENTS

BY

PEKKA TALA AND LAURI VIRKKULA

From the Clinic for Thoracic Surgery, University of Helsinki, Finland

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Regardless of the exact diagnosis, patients with a solitary, circumscribed radiologically visible mass in the lung should be considered a uniform group, since in about two-thirds of the cases the pre-operative examinations can lead no farther than to recognition and localization of the shadow. Studies have been published during the past decade of large series of surgically treated patients and the nature of the pulmonary lesions has been analysed. The conclusion drawn from the studies is the fact, already emphasized by Alexander in 1942, that thoracotomy is indicated in nearly every case, since a large proportion of these lesions are malignant.

In a series consisting of 156 patients who underwent surgery at the Mayo Clinic, Hood, Good, Clagett, and McDonald (1953) observed that a solitary circumscribed lesion in the lung is malignant in 35.3%. This incidence was 47% in the series of Davis, Peabody, and Katz (1956) and 42.3% in that of Linder and Jagdschian (1959). The latter investigators calculated the proportion of malignant lesions in the 2,057 operated cases previously reported in the literature and obtained an incidence of 31.9%. In the series published from our clinic the percentage of malignancy was 68.5.

The malignant solitary pulmonary tumour differs from the common bronchogenic carcinoma obstructing a bronchus in the following respects: It is evidently asymptomatic for a longer time; it is readily regarded as a benign tumour, and because of its peripheral situation its exact diagnosis is more difficult. On the other hand, it is probably better suited for surgical removal.

Vance, Good, Hodgson, Kirklín, and Gage (1959) conducted a three-year follow-up study in 94 cases of surgically treated pulmonary carcinoma. In their series the survival rates were no better than in the entire series of pulmonary carcinoma at their clinic, but the resectability rate was considerably higher and the hospital mortality rate lower than in the total pulmonary carcinoma series.

The present follow-up study was made among patients with a solitary malignant pulmonary tumour treated at the Clinic for Thoracic Surgery of the University of Helsinki in 1948–58. These patients were included in the 200 cases of solitary pulmonary lesions previously reported by Peräsalo, Laustela, and Hallamaa (1959).

MATERIAL AND METHOD OF STUDY

The criteria according to which the cases of solitary pulmonary tumour were selected for this study have been described earlier (Peräsalo and Tala, 1959). The diagnosis was always based on the pathological examination of the excised lesion. July 1, 1959, was set as the follow-up date. Data on patients who did not attend follow-up examination at the clinic after this date were obtained by post, and when necessary an inquiry was made at the Central Statistical Office and the National Pensions Institute. The above-mentioned series of Peräsalo and Tala contained 137 malignant solitary pulmonary lesions, consisting of 114 bronchogenic carcinomas and 23 other malignant tumours. In the present study it has been possible to include 97 of the bronchogenic carcinomas, as in 12 cases less than one year had elapsed between the operation and the follow-up date and no response was obtained from five patients. For the same reasons 20 of the original 23 cases of other malignant tumours could be covered by this study. Thus the series included 99 men and 18 women. The male:female ratio was 89:8 in the bronchogenic carcinoma group and 10:10 in the group of other malignant tumours.

TABLE I
AGE AND SEX DISTRIBUTION OF 97 PATIENTS WITH
BRONCHOGENIC CARCINOMA PRESENTING AS A
SOLITARY CIRCUMSCRIBED PULMONARY LESION

Age in Years	Total	Male	Female
30–39	4 (4.1%)	2 (2.2%)	2 (25%)
40–49	29 (29.9%)	25 (28.1%)	4 (50%)
50–59	48 (49.5%)	46 (51.7%)	2 (25%)
60–69	16 (16.5%)	16 (18%)	—
Total:	97 (100%)	89 (100%)	8 (100%)
Mean (years)	52.5	53.5	44.5
Youngest ..	36	36	37
Oldest ..	65	65	54

RESULTS

BRONCHOGENIC CARCINOMA.—Table I shows the distribution of the patients by age and sex.

Pulmonary resection was possible in all the 97 cases. The operative procedures were as follows: Pneumonectomy in 51, lobectomy in 40, and segmental resection or local excision in six. Six patients (6.2%) died in the hospital, three after lobectomy and three after pneumonectomy. One of the patients died in a traffic accident nearly two years after operation and one committed suicide. These two patients and those who died in the hospital were omitted in calculating the survival figures, there remaining 89 patients. In three of these the tumour was adherent to the thoracic wall and in some others, also, it was evident that excision of all the diseased tissue had not been possible. However, cases of this kind were not excluded from the survival figure calculation.

Table II gives the distribution by cell types of the 97 bronchogenic carcinomas. A cytological examination of the sputum or bronchial washings was made in 73 of the 97 cases; 17 of these examinations (23%) were positive for carcinoma cells. A bronchoscopic examination was made in 83 patients. In only 18 of these examinations (21.7%) was a positive diagnosis made histologically. Hilar or mediastinal nodes were positive for carcinoma cells in 22 cases of 96 (22.8%); in one case no information was available on this point.

The survival among patients followed for one to five years is presented in Table III. There were 89 patients who were followed for one year, 50 for three years, and 30 for five years. The survival rates were 66.3, 34.0, and 26.6%, respectively.

Table IV gives the three- and five-year survival rates according to cell types. Although the number of cases is small to serve as a basis for conclusions,

TABLE II

CELL TYPES IN 97 PATIENTS WITH BRONCHOGENIC CARCINOMA PRESENTING AS SOLITARY, CIRCUMSCRIBED, PULMONARY LESION

Cell Type	No. of Patients
Squamous cell	41 (42%)
Undifferentiated carcinoma	32 (33%)
Adenocarcinoma	23 (24%)
Alveolar cell	1 (1%)
Total	97 (100%)

TABLE III

SURVIVAL RATES ONE TO FIVE YEARS IN 89 PATIENTS WITH SOLITARY, CIRCUMSCRIBED, PULMONARY LESION DUE TO BRONCHOGENIC CARCINOMA

Survival Time in Years	No. of Surviving Patients	No. of Patients Traced	Survival (%)
1	59	89	66.3
2	29	69	42.0
3	17	50	34.0
4	10	37	27.0
5	8	30	26.6

TABLE IV

THREE- AND FIVE-YEAR SURVIVAL RATES ACCORDING TO CELL TYPES IN PATIENTS WITH SOLITARY, CIRCUMSCRIBED, PULMONARY LESIONS DUE TO BRONCHOGENIC CARCINOMA

Cell Type	No. of Patients Followed Three Years	No. Living Three or More Years After Operation	No. of Patients Followed Five Years	No. Living Five or More Years After Operation
Squamous cell	25	6 (24%)	16	1 (12.5%)
Undifferentiated	12	4 (33%)	7	3 (29%)
Adenocarcinoma	13	7 (54%)	7	4 (57%)
Total	50	17 (34%)	30	8 (26.6%)

TABLE V

THREE-YEAR SURVIVAL RATES ACCORDING TO DIFFERENT VARIABLES IN PATIENTS WITH SOLITARY, CIRCUMSCRIBED, PULMONARY LESIONS DUE TO BRONCHOGENIC CARCINOMA

Variable	Number of Patients	No. Living Three or More Years
Delay in treatment:		
Six months or less	30	11 (37%)
More than 6 months	20	6 (30%)
Total	50	17 (34%)
Thoracic symptoms:		
Present	25	8 (32%)
Absent	25	9 (36%)
Total	50	17 (34%)
Size of lesion:		
4.0 cm. or less	26	8 (31%)
More than 4.0 cm.	24	9 (37.5%)
Total	50	17 (34%)
Sedimentation rate (mm. in one hour):		
30 or less	24	10 (42%)
More than 30	26	7 (27%)
Total	50	17 (34%)
Cytological findings:		
Positive	9	3 (33%)
Negative	28	9 (32%)
Unknown	13	5 (38%)
Total	55	17 (34%)
Operation:		
Pneumonectomy	33	13 (39%)
Lobectomy	12	3 (25%)
Excision or segmental resection	5	1 (20%)
Total	50	17 (34%)
Nodal involvement:		
Present	10	2 (20%)
Absent	39	15 (38.5%)
Unknown	1	—
Total	50	17 (34%)

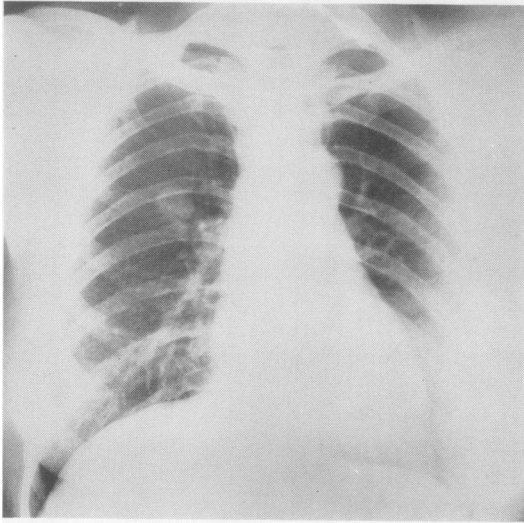


FIG. 1a

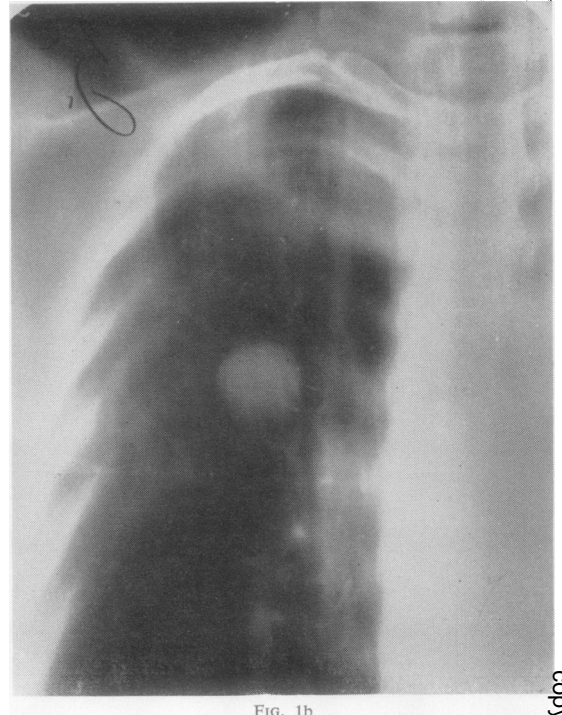


FIG. 1b

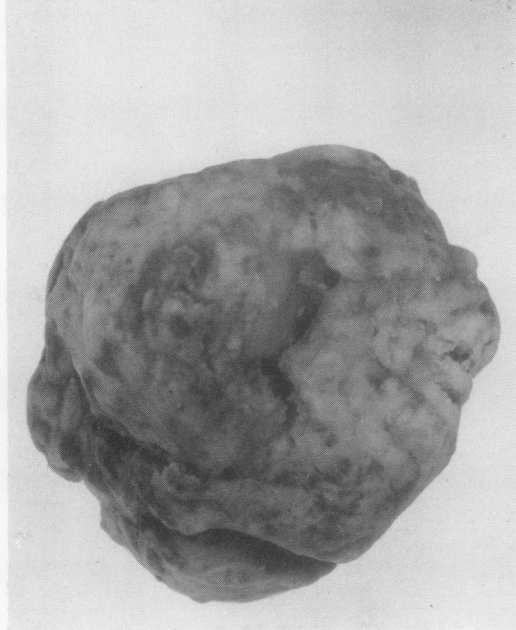
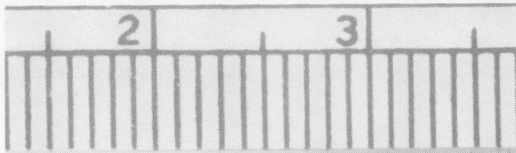


FIG. 1c

FIG. 1 (a, b, and c).—Chest radiographs of a 42-year-old woman with an adenocarcinoma the size of a table-tennis ball in the right upper lobe. The tumour was regarded as benign and enucleation was performed. The patient is living without recurrences over four years after operation.

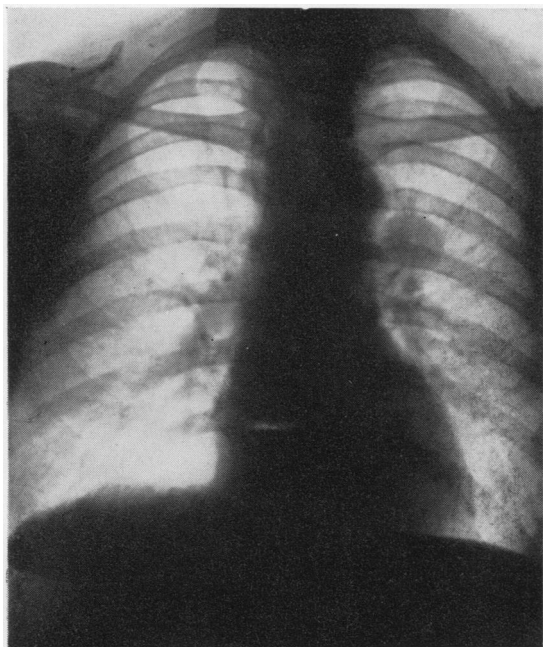


FIG. 2a



FIG. 2b

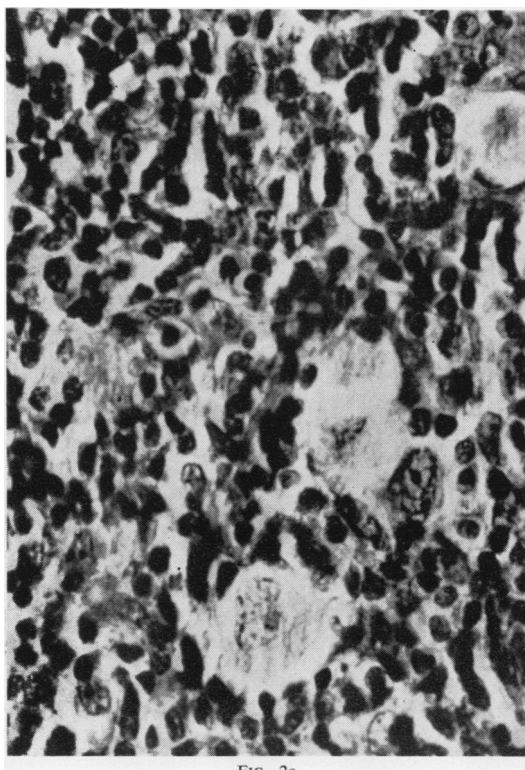


FIG. 2c

FIG. 2 (a, b, and c).—Chest radiographs of a woman, aged 43, with malignant thymoma presenting at first as a solitary nodule in the hilar region of the left lung. The patient died five years after local excision. Photomicrograph ($\times 400$) of the tumour, in which epithelial reticulum cells and thymocytes are seen.

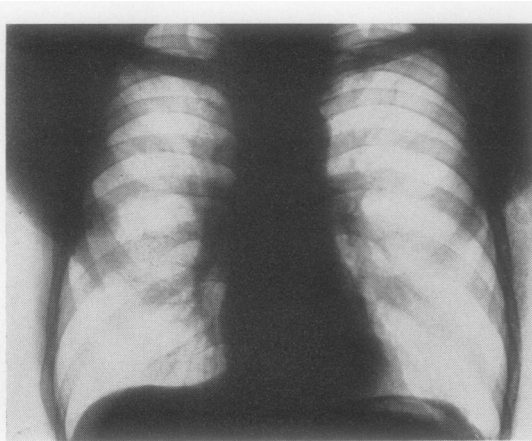


FIG. 3a

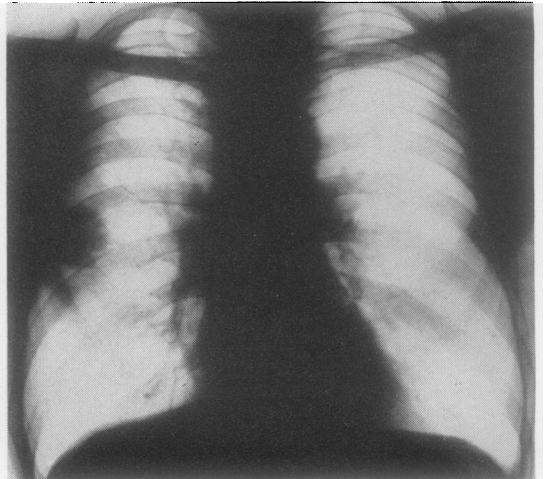


FIG. 3b

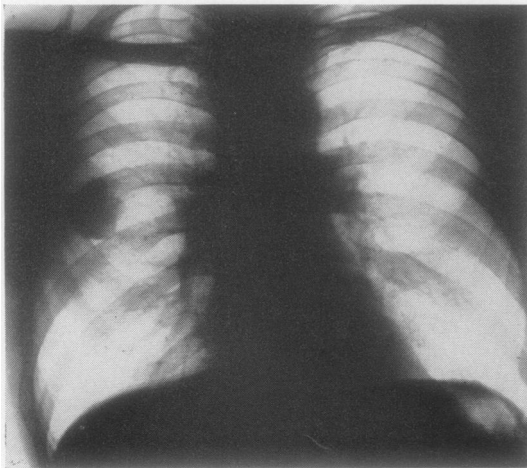


FIG. 3c

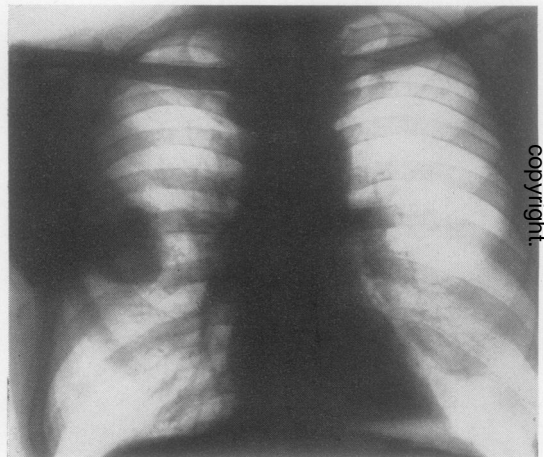


FIG. 3d

FIG. 3 (a, b, c, and d).—Chest radiograph of a man aged 53. The adenocarcinoma in the right upper lobe was regarded as benign and the patient was under observation for two years. Pneumonectomy was performed on February 7, 1951. The patient is living, free of symptoms and working, nearly nine years after the operation.

the adenocarcinoma group appears to show the best values in both the three-year and five-year groups.

In Table V the influence of various factors on the three-year survival rate is studied. The five-year group was considered to be too small for such a review. In studying the time that passed from the diagnosis of the tumour or onset of the symptoms to surgical operation no notable difference is observed in favour of the patients who underwent operation after a short delay. In the total group of 97 patients the mean delay before treatment was 7.3 months.

The presence of thoracic symptoms, size of lesion, and positive results of the cytological examination

of sputum or bronchial washings appear to have very little influence on the survival rate. On the other hand, the survival time seemed to be longer if the patients had a low sedimentation rate, if malignant cells were not encountered in the mediastinal or hilar lymph nodes, or if the resection was extensive. It should be borne in mind, however, that the series from which the above-mentioned figures are calculated is too small for definite conclusions.

Four patients had osteoarthropathy, which was the first symptom in all of them. One patient later had a cough and blood-stained sputum, which led to the diagnosis of the tumour; in the other cases the tumour was revealed at a general examination

made because of pain in the joints. With one exception these patients are dead, one having died at the hospital of pulmonary embolism and two less than one year after operation. More than eight years have passed since the operation on the surviving patients. In this case carcinomatous tissue was encountered also in the hilar nodes. No x-ray therapy was given pre- or post-operatively.

Patients who were operated upon five years ago or earlier numbered 30. Eight of these (26.6%) have survived five years and are living, five for over five years, one for over six years, and two for over eight years. All the patients surviving over five years are men. In these eight patients, pneumonectomy was performed on seven and lobectomy on one. Carcinoma cells were found in the hilar nodes in one of these patients. In three patients the lesion was over 4 cm. in size and in the other five patients it was about 3 cm. in diameter. There was an adenocarcinoma in four patients, an undifferentiated carcinoma in three patients, and a squamous-cell carcinoma in one patient.

RARE PULMONARY MALIGNANCIES.—As is seen in Table VI, there evidently was a primary pulmonary sarcoma in eight patients, six of whom were men. Pneumonectomy was performed in three cases, lobectomy in two cases, excision of tumour in two cases, and explorative thoracotomy in one case. Two patients survived over three years; one of them is still living, over six years after lobectomy.

The eight cases of solitary pulmonary metastases included three men and five women. The primary tumours were carcinoma of the breast, rectal carcinoma, hypernephroma, malignant melanoma of the skin, osteal sarcoma, osteogenic sarcoma, adrenal carcinoma, and malignant paraganglioma (Virkkula, 1959). The surgical operation was pneumonectomy in two cases, lobectomy in three cases, and segmental resection or local excision of tumour in three cases. Of these, three patients survived over one year, one of them being alive nearly two years after bilateral removal of pulmonary metastases from an adrenal carcinoma.

TABLE VI

SURVIVAL RATES IN PATIENTS WITH SOLITARY, CIRCUMSCRIBED, PULMONARY LESIONS DUE TO MALIGNANT GROWTHS OTHER THAN BRONCHOGENIC CARCINOMA

	Number of Patients	No. of Patients Surviving One Year	No. of Patients Surviving Three Years	No. of Patients Surviving Five Years
Primary sarcoma	8	4	2	1
Metastatic tumours	8	3	—	—
Thymoma	1	1	1	1
Bronchial adenoma	3	3	2	2

Our only patient with malignant thymoma was a woman in whom the first manifestation of the disease was a solitary nodule in the lung. Local excision was performed and the patient died five years after the operation. The three patients operated upon for bronchial adenoma in this series are living and without symptoms eight, six, and one year after the operation.

COMMENT

In our total series of solitary malignant pulmonary lesions the pre-operative examinations showed in 35 out of 117 cases (29.9%) that the lesion was malignant. These examinations were bronchoscopy and/or cytological examination of sputum and in one case aspiration biopsy from the tumour. Knowledge of the malignancy of the lesion was thus obtained in 31% in the bronchogenic carcinoma group and in 25% in the group of other malignant tumours.

Resection was possible in 116 of the 117 cases. In one case of primary sarcoma of the lung an explorative thoracotomy only was performed. Thus the resectability rate was 99.1%. For bronchogenic carcinoma the rate was 100%, the corresponding rate in the series of Vance *et al.* (1959) being 90%. In view of the high rate of resectability the overall survival in cases of bronchogenic carcinoma occurring as a solitary tumour is evidently considerably better than in other forms of bronchogenic carcinoma.

The hospital mortality rate in the total series was six out of 117 patients (5.1%). All the hospital deaths occurred in cases with bronchogenic carcinoma, in which the hospital mortality rate thus was 6.2%, compared with 5.3% in the series of Vance *et al.* In the total series of bronchogenic carcinomas treated in our Clinic this figure is 14% (Peräsalo *et al.*, 1959). Accordingly the primary mortality is definitely lower in cases of solitary bronchogenic carcinoma. The one-, three-, and five-year survival rates were 66.3%, 34.0%, and 26.6%, respectively. The three-year survivals in the series of Vance *et al.* totalled 36.6%, compared with our 34.0%. We have not in the present series calculated a survival rate corresponding to that of Vance *et al.* in a series in which "all the apparent carcinoma was removed" and in which the three-year survival rate was 44.7%. Compared with the series of Peräsalo *et al.* (1959) covering all the bronchogenic carcinomas in this Clinic, the survival rates for solitary bronchogenic carcinoma are better. In the series covering all cases of carcinoma of the lung the one-, three-, and five-year survival rates were 29.5%, 23.4%, and 15.3%, respectively. In the series of Vance *et al.*

(1959) no difference was seen in the three-year survival rates when the cases of solitary bronchogenic carcinoma were compared with the total number of cases of carcinoma of the lung in their clinic.

A comparison of the relationship between the various cell types of bronchogenic carcinoma and the survival rates shows the best results in the adenocarcinoma group after both three and five years. In examining the influence of various factors on the three-year survival rate a better result is observed when the patient had a low sedimentation rate, if malignant cells were not found in the hilar nodes, or if pneumonectomy instead of a more limited resection was performed. However, the series from which the above-mentioned values are calculated is too small to warrant definite conclusions.

SUMMARY

In a series of 117 surgically treated patients with malignant tumour of the lung manifesting as a solitary circumscribed lesion in the thoracic radiograph, the pre-operative examinations revealed the malignancy of the tumour in 29.9%. The resectability rate in the total series was 99.1%, being 100% for bronchogenic carcinoma. The hospital mortality rate was 5.1% in the total series and 6.2%

in the bronchogenic carcinoma group. The one-, three-, and five-year survival rates in the solitary pulmonary carcinoma series were 66.3%, 34.0%, and 26.6%, respectively.

In studying the effect of various factors on the survival figures a better result was observed if the tumour was an adenocarcinoma, if the sedimentation rate was low, if malignant cells were not encountered in the hilar nodes, or if an extensive resection (pneumonectomy) was performed. The hospital mortality rate is lower and the survival rates better than in an earlier series covering all the cases of bronchogenic carcinoma in the same clinic. Since, additionally, bronchogenic carcinoma presenting as a solitary tumour has a considerably higher resectability rate, this group has a better prognosis than other forms of pulmonary carcinoma. The survival times are reported for the 20 cases of rare malignant pulmonary tumours in the series.

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