Surgery for Pulmonary Cancer,
A Declaration of Dividends

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Three- and five-year cures among individuals, once victims of pulmonary cancer, make up a constantly expanding group. A search for common factors in the extent, characteristic and management of their disease was undertaken in these fortunate individuals.

Selected groups from a 23-year experience with over 1400 cases of primary lung cancer (excluding all cases of bronchial adenoma) serve as the basis for this report. Within the groups discussed, all cases are consecutive and all are histologically verified. All survival statistics are referred either to the total number of cases considered in each group or to all resections for a particular period of time. The follow-up of 683 verified cases to 1951 is complete with the exception of one case. There is a 93.5 per cent complete follow-up in cases first seen from 1951 to 1953. For statistical purposes, all cases not followed are considered dead. Operative mortality figures include all hospital deaths following induction of anesthesia for thoracotomy as well as all other deaths occurring from any cause within 30 days of surgery.

Extent of Cancer

To determine the extent of the cancer in patients who survived pulmonary resection five or more years, 588 cases of histologically verified cancer were studied. These cases were seen first during the 18-year period from 1932 to 1950. Two hundred and four (35 per cent) had resections with an overall mortality of 15 per cent. At the time of surgery, the cancer appeared localized to the lung in 39 per cent of the cases. Sixty-one per cent had tumors which had extended to the mediastinal lymph nodes or grossly to other thoracic structures. Of the 204 patients who had resections, 46 (23 per cent) survived five or more years without any evidence of recurrence. Several, in addition, survived three or more years, then died from other than causes attributable to their pulmonary disease, and necropsy demonstrated no evidence of residual carcinoma anywhere in the body. One of the 588 was lost to follow-up. His diagnosis had been verified by biopsy of a peripheral lesion and no thoracotomy was performed.

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An unusual finding was that 14 (30 per cent) of the 46 five-year survivors were patients who had resections for cancers which had extended beyond the confines of the lung (Fig. 1A and 1B). These resections had been considered palliative. Surgery had been done to relieve patients of disabling symptoms with the additional hope that their lives might be prolonged. However, in some, an unenvisioned cure resulted. These represented an unexpected bonus of "palliative surgery."

Of 80 patients who had resections of cancers which had extended grossly outside the lung, four (5 per cent) survived five years or more. Of 44 patients who had resections of cancer which had spread to mediastinal lymph nodes, 10 (22 per cent) survived five years. Thirty-two (40 per cent) of the 80 patients with resections of localized pulmonary cancers lived five years (Table I). This survival rate in patients who had cancers extending outside the lung is very similar to the five-year survival of

| TABLE I |
|-----------------|-----------------|
| LUNG CANCER VERIFIED OVERHOLT THORACIC CLINIC 1932-1950 |
| 5 YEAR SURVIVORS — EXTENT OF INVOLVEMENT |
| Total | 588 |
| Resected | 204 |
| 5 Year Survivors | 46 |
| 8 Per Cent of All Patients | 23 Per Cent of Resected |
| Localized | 32 |
| Mediastinal L N Involved | 10 |
| Gross Extension | 4 |

Figures 1A and 1B: Mr. S. W. Age 49. Pre-operative x-ray film showing right upper lobe lesion. Symptoms had been present for 18 months. Mediastinal involvement was anticipated, and found, due to the high location of the centrally placed epidermoid carcinoma.—Figure 1B: Mr. S. W. Post-operative x-ray film nine years 4 months after right pneumonectomy. During these years, patient has been well and there has been no evidence of recurrence.
"one in ten" reported in 1952 by Ochsner et al.¹ In striking contrast, however, is the experience of Churchill et al who reported in 1950 that no five-year survivors were found among patients with positive lymph nodes in the resected specimen.²

Fortunately, there are indications from the number of three- and four-year survivors that the extra dividend of five-year survivors from palliative resection may increase. Soon more five-year follow-ups will become available from patients who have undergone pulmonary and mediastinal lymph-node resection by the improved techniques of more recent years. Failure of x-ray therapy to prolong useful and comfortable life and a growing dissatisfaction with x-ray therapy for relief of symptoms other than of bone pain and superior mediastinal obstruction have given added impetus to attempts at surgical palliation (Table II). With the newer devices now available for postoperative care, more cases can be ambulated in three days and discharged from the hospital with a total stay of two weeks. This means that the expense, discomfort and disability may be far less with surgery than with supervoltage radiation or chemotherapy. Recently, excision has become a reasonable and more logical solution for palliation than heretofore and is used more frequently. The impact of excisional therapy on the bronchial obstruction and associated inflammatory factors is immediate. Cough disappears, breathing ability improves and often pain can be completely relieved for considerable periods of time. Radiation and chemotherapy can be used to complement or supplement

Table II

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<th>Years</th>
<th>Cases %</th>
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<tbody>
<tr>
<td>0</td>
<td>87%</td>
</tr>
<tr>
<td>1</td>
<td>41%</td>
</tr>
<tr>
<td>2</td>
<td>25%</td>
</tr>
<tr>
<td>3</td>
<td>15%</td>
</tr>
<tr>
<td>4</td>
<td>12%</td>
</tr>
<tr>
<td>5</td>
<td>11%</td>
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1941-50

71 RESECTED-LOCALIZED
112 RESECTED-EXTENDED
225 NO SURGERY

[Graph showing survival rates by years for resected-localized, resected-extended, and no surgery cases.]
excisional therapy if and when metastatic disease progresses to demand further attempts at palliation.

Pathology

Although epidermoid carcinoma was the predominant lesion resected from the 46 patients who survived five years, more undifferentiated tumors and adenocarcinomas were found than had been anticipated. Thirty-four of the cancers were epidermoid; seven were undifferentiated; and five adenocarcinomas (Table III). Among the undifferentiated cancers were four with epidermoid and simplex foci, one of large-cell type, and two small-cell types. Two of the adenocarcinomas were bronchiolar carcinomas, apparently a more benign type of pulmonary cancer.\textsuperscript{3,4,5} Three were well-differentiated adenocarcinomas. There was no evidence on careful study that these tumors arose from benign adenomas. The tumors of all histologic types ranged from one to eight centimeters in greatest diameter.

In 43 resected specimens where the location of the lesion could be established, 25 were located peripherally to the main lobar bronchi; 18 were

### Table III:

<table>
<thead>
<tr>
<th>Total</th>
<th>46</th>
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<tbody>
<tr>
<td>Epidermoid</td>
<td>34</td>
</tr>
<tr>
<td>Undifferentiated</td>
<td>7</td>
</tr>
<tr>
<td>Adenocarcinoma</td>
<td>5</td>
</tr>
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</table>

**Figure 2A:** Mr. M. A., age 45. Symptoms of cough and occasional hemoptysis were present for five months. Pre-operative x-ray film revealed areas of cavitation in the left postero-apical segment. At thoracotomy in October, 1945, all mediastinal and hilar nodes were found to be negative. The involved segment was removed for total biopsy. The frozen-section report was chronic granuloma. Subsequently, permanent sections revealed undifferentiated carcinoma.---**Figure 2B:** Mr. M. A. A post-operative x-ray film five years and one month after a curative segmental resection. Patient is asymptomatic and actively engaged in business.
TABLE IV
LUNG CANCER VERIFIED OVERHOLT THORACIC CLINIC 1941-1952

<table>
<thead>
<tr>
<th>Number</th>
<th>Survived 3 years or more Per Cent</th>
<th>Number</th>
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</thead>
<tbody>
<tr>
<td>Conservative Resection</td>
<td>24</td>
<td>29 (7)</td>
</tr>
<tr>
<td>Radical Resection</td>
<td>302</td>
<td>26 (78)</td>
</tr>
<tr>
<td>X-Ray Treatment</td>
<td>64</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

located centrally; 24 were in the upper lobe; 12 were in the lower lobe; six were encroaching upon the main-stem bronchi; and one was in the middle lobe.

The fact that one-fourth of all five-year survivors had resections for undifferentiated and adenocarcinomas is cause for definite encouragement.

**Extent of Resection**

During the 12 years from 1941 to 1953, 42 segmental resections, lobectomies or bilobectomies were performed for primary verified lung cancer. In the same period, 327 pneumonectomies were done.

There were 40 operative deaths (12 per cent) among the patients who had pneumonectomies (38 per cent were for localized lesions and 62 per cent for lesions which had extended grossly or to mediastinal lymph nodes). By way of approximate comparison, there were four operative deaths (9.5 per cent) in the patients who had lobectomies (40 per cent of these were for localized lesions and 60 per cent were for lesions which had extended). One hundred and eight (33 per cent) of the patients who had pneumonectomy were known to be living more than one year since surgery. Twelve (29 per cent) of the patients who had lobectomy were alive more than one year.

A consideration of the resections performed between 1932 and 1952 permits a determination of three-year survival. In that period, 24 pa-
Patients had lobectomies; seven (29 per cent) are living and well. Three hundred and two pneumonectomies were done; 78 (26 per cent) are alive and well. Sixty-four patients had x-ray therapy alone—some of them, two million volt x-ray, usually for advanced disease; none survived more than three years (Table IV).

It is not our intention here to present this small group of limited pulmonary resections as statistical evidence for or against the selection of such procedures in surgical therapy of primary pulmonary carcinoma. Rather, our purpose is to present this data as a necessary and thought-provoking "book-keeping" of surgical experiences in the field of lung cancer. We must agree with Churchill et al, that under carefully considered conditions, lobectomy may be a better procedure than pneumonectomy might be for the individual patient.

Our general policy in surgical therapy of lung cancer has been to achieve, whenever possible, a pneumonectomy with as extensive a resection of mediastinal lymph nodes as seems reasonable. Paratracheal nodes, carinal nodes, lymphatics in the inferior pulmonary ligament and lymph nodes from the contralateral side of the mediastinum have been removed. Intrapericardial ligation of pulmonary vessels is done when it facilitates the dissection or when partial pericardiectomy is necessary to stay well beyond tissues invaded by the tumor. Surgical judgment in the individual patient prompted lobectomy in the occasional case. Palliation of clearly incurable cancer in patients with limited cardiac or pulmonary reserve was the most frequent reason for limited resection. These were performed to relieve the patient of incapacitating symptoms, such as, pain, infection or hemorrhage. In a few patients, it was felt that all the tumor could be removed by the limited resection. In two, only a segmental resection was

**TABLE VI**

![Graph showing surgical outcomes over different years](image-url)
surgey for pulmonary cancer

1932-1940
1941-1948
1946-1950
1951-
1953

157
138
138
29
29
Z53
2.14

carried out (Fig. 2A and 2B). Some of the lobectomy cases had been followed by x-ray for several years and were undiagnosed until total biopsy was done by using the lobe as the unit for resection. A radical removal of mediastinal lymph nodes was also carried out. When lymph nodes resected from the mediastinum were reported negative for tumor on frozen-section examination and the physiologic age and cardiopulmonary function of the patient were considered, it seemed wise to avoid sacrifice of more pulmonary tissue. Also, we feel it extremely important not to do anything less than a total biopsy in any suspect case because of the danger of spilling tumor cells into the operative field.

With the improvement of resection techniques, anesthesia, blood banks, antibiotics and ancillary supportive services, the operative mortality has fallen steadily (Table V). Now, the period of palliative surgical extirpation of moderately and far-advanced lung cancer is maturing.

Thoracotomy and resection rates of patients arriving at our clinic have risen steadily (Table VI). Almost three-fourths of all the patients seen have been explored, and two-thirds of these have been found to be resectable (Table VII). Although statistics from a thoracic surgical clinic cannot be interpreted as a trend for the therapy of the disease as a whole, it is encouraging to see similar trends in clinics and hospitals elsewhere in the country.¹²⁹

Most encouraging has been evidence that now more patients are coming to thoracotomy earlier in the course of their disease. Patients and their families are more aware of the need for routine chest x-ray examinations. X-ray examination is being requested earlier and more frequently by practicing physicians. There is a fuller realization that negative cytology and negative bronchoscopy do not rule out malignancy. The delay at-

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<td>1932-1940</td>
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<tr>
<td>1941-1948</td>
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<tr>
<td>1946-1950</td>
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<tr>
<td>1951-1953</td>
</tr>
</tbody>
</table>

| RESECTED | 18 | 67 | 157 | 138 |
| THORACOTOMY | 43 | 129 | 253 | 214 |
tributable to physicians in the cases here reported has decreased from 11 to three and one-half months (Table VIII).

Of 30 patients with x-ray survey-discovered lung cancer seen at the Overholt Thoracic Clinic between December, 1947, and April, 1951, nine (30 per cent) survived three years. This over-all survival is heartening, although fully one-third of the patients delayed their search for surgical therapy until striking symptoms caused them alarm. In recent years, the educational program concerning the cancer potential of the silent shadow is beginning to bear fruit. Of 16 silent cases explored within three months of the discovery film, all were resectable and 11 were found to be localized.

The gravity of the situation for the individual who harbors a carcinoma of the lung brings into sharper focus the more important issue—that of prevention. The cause of cancer is not known. The growing evidence that addiction over long periods of years to the inhalation of tobacco smoke is an aggravating factor cannot be overlooked. Doctors can well be advised to concentrate some of their efforts toward this problem as it may well lessen their burden of case-finding and therapy.

SUMMARY

Forty-six patients who survived five or more years after resection for pulmonary carcinoma have been discussed. Factors which relate to curability from this and an over-all experience with the management of patients between 1932 and 1953 are given.

Epidermoid cancer treated prior to gross or microscopic evidence of extension beyond the lung gives the best prognosis. The higher grades of malignancy (Undifferentiated, oat-cell, etc.) are not always hopeless. In fact, seven of the 46 five-year survivals were treated for malignancies of this type.
Palliative surgery may turn out to be curative. Over 10 per cent of those originally considered hopeless have been saved.

The extent of the resection must be based on the location and character of the lesion as well as upon the functional capacity of the contralateral lung. A limited resection has proved to be adequate and a preferable method of management for selected individuals.

Higher cure rates can be predicted in the future as more explorations are done to determine the nature of lesions which produce silent abnormal densities in chest films.

RESUMEN

Se discuten los casos de cuarenta y seis enfermos que han sobrevivido el término de 5 o más años después de resección pulmonar por carcinoma. Se proporcionan los factores que están en relación con la curabilidad así como el resultado de la experiencia general en el tratamiento de enfermos de estos entre 1932 y 1953.

El cáncer epidermoide tratado antes de evidencia gruesa o microscópica de extensión fuera del pulmón, tiene el mejor pronóstico. Los de más elevada malignidad (no diferenciados, de células avenoides, etc.) no son siempre desesperados. De hecho, siete de las sobrevividas a los 5 años que son 46, se trataron por neoplasias malignas de ese tipo.

La cirugía paliativa puede resultar curativa. Más de 10 por ciento de los considerados desesperados se han salvado.

La extensión de la resección debe basarse en la ubicación y carácter de las lesiones así como en la capacidad funcional del otro pulmón. Una resección limitada ha demostrado ser adecuada y preferible para ciertos individuos.

Se pueden prever proporciones de curación más altas en el futuro a medida que se hagan exploraciones para determinar la naturaleza de las lesiones silenciosas que producen densidades asintomáticas en la película radiográfica.

RESUME

Les cas de 46 malades ayant survécu pendant cinq ans et plus, a une résection de cancer pulmonaire, ont été discutés. On présente les facteurs ayant influé sur la curabilité de cette série ainsi que le compte rendu général sur le traitement des malades entre 1932 et 1953.

Le cancer épidermoïde traité avant qu'il y ait événue pathologique ou microscopique d'une extention hors du poumon, a le meilleur prognostique.

La chirurgie palliative peut devenir curative. Plus de 10% des malades considérés comme perdus a l'origine, ont été sauvés. Les degrés les plus avancés de malignité (non différenciées, microcellulaires, etc.) ne sont pas toujours sans espoir. En fait 7 de ces 46 malades ont été traités pour des tumeurs de cette sorte, et ont survécu cinq ans.

L'extension de la résection doit être basée sur la location et le caractère de la lésion aussi bien que sur la capacité fonctionnelle du poumon contralatéral. Il a été prouvé qu'une résection limitée est suffisante et préférable pour certains malades.

On peut prédire un pourcentage plus élevé de guérisons dans l'avenir.
si l'on tient compte du plus grand nombre d'explorations faites pour déterminer la nature des lesions asymptomatiques qui produisent des densites anormales sur les radios pulmonaires.

**ZUSAMMENFASSUNG**

Es wurden 46 Kranke, die 5 oder mehr Jahre nach einer Resektion wegen Lungen-Carcinom noch am Leben waren, besprochen. Die Faktoren, die zur Heilbarkeit beitragen, werden anhand der Erfahrungen aus diesem und dem gesamten Behandlungsmaterial zwischen 1932 und 1955 dargestellt.

Der Epidermoid-Krebs hat die beste Prognose, sofern er behandelt wird, bevor mit bloßem Auge oder mikroskopisch eine Ausdehnung über die Lunge hinaus in Erscheinung tritt. Nicht immer sind die stärkeren Grade der Bösartigkeit (undifferenziert, Sichelzellen) hoffnungslos. Wurden doch 7 von den 46 Kranken, die die Fünfjahresgrenze überlebten, wegen bösartiger Tumoren dieses Types behandelt.

Eine palliative Operation kann sich als eine curative erweisen. Über 10% der ursprünglich als hoffnungslos betrachteten Patienten sind gerettet worden.

Die Ausdehnung der Resektion muss ausgehen sowohl von der Lokalisation und dem Charakter der Veränderung als auch der funktionellen Kapazität der kontralateralen Lunge. Für ausgewählte Einzelfälle hat sich eine begrenzte Resektion als entsprechend und als eine bessere Behandlungsmethode erwiesen.

Es ist möglich, ein grüßeres Verhältnis von Heilungen für die Zukunft anzunehmen, da mehr Untersuchungen angestellt werden zur Bestimmung der Natur von Veränderungen, die zu stummen abnormen Verdichtungen auf Thorax-Röntgenaufnahmen führen.

**REFERENCES**