The interest in primary carcinoma of the lung aroused in the last decade by the increase, real or apparent, in its incidence, has been greatly stimulated in the last few years by the recognition of its identity with a disease long known among the miners of the Erzgebirge as Bergkrankheit. Although cancer of the lung is not often mentioned in the older literature, its symptoms were noted as early as the sixteenth century by Johannes Agricola. It is also mentioned by Morgagni, who in 1766 first described the pathology of pulmonary tumors and gave a full autopsy record in which we can at present recognize the description of carcinoma of the lung.

Huguenin, in his monograph of four hundred pages, credits Corvisart and Boerhave with the first clinical description of this disease, while Bayle is given credit for having isolated cancer from the chaos of pulmonary phthises in 1800. Corvisart, however, antedates Bayle, having published a case two years earlier. Laennec in 1819, in his *De l'auscultation médiate*, first described pulmonary cancer as "encephaloid of the lung" and gave as exact a description of the physical signs as was possible without the x-ray or bronchoscope. Stokes in *Diseases of the Chest*, London, 1837, stated that frequent and severe bronchitis, resisting the usual methods of treatment, is suspicious of malignant tumor. He also gave an account of the physical signs and the qualities of the sputum, and differentiated between these signs and those due to aneurysm.

Virchow's masterly study of tumors of the lung in 1863 introduced the modern concept of this pathological condition. In 1911 Adler, in a study of primary carcinoma of the lung, found in the literature 360 cases, as compared to only 57 collected by Pässler in 1896. "The failure of recognition of cancer of the lung," wrote Adler, "has for a long time perpetuated the dogma of its rarity."

For the last two decades reports of pulmonary carcinoma have become increasingly numerous in the literature, all of them showing a rising incidence of this condition, from both the pathological and clinical point of view. Most
of these are from German sources. Hamman notes that two authors, Rosahn and Fried, using the same statistical material, arrive at diametrically opposite conclusions. Rosahn writes: "The post-mortem incidence of primary carcinoma of the lung is steadily increasing and this increase is real and absolute." Fried, on the other hand, regards the increase as "very likely more apparent than real.

Among the higher figures are those of Junghanns of Dresden, who in all autopsies from 1893 to 1927, found bronchial carcinoma in 1.67 per cent of the total. Dividing his material into four-year periods, he found that from 1893 to 1897, 14.12 per cent of all cancer was primary in the lung, while in the next two four-year periods the percentages were 11.62 and 11.54. Then began a gradual rise, until in 1923–27 the proportion of pulmonary cancer to all cancer was 20.68 per cent. Seyfarth of Leipzig, whose figures do not run quite so high, reports a rise from 5.01 per cent in 1900–06 to 8.75 in 1919–23, and 15.5 in the first half of 1924. These figures are higher than the figures currently quoted elsewhere in Germany. Katz, of Heidelberg, found an increase from 2.09 per cent in 1906 to 11.1 per cent in 1925. Probst of Zurich reports a rise from 1.13 in the period 1906–10 to 7.56 in the single year 1926. Berblinger of Jena gives 2.2 per cent for 1910 and 8.3 per cent for 1920–24. As Leipzig and Dresden are both in Saxony, it is possible that the proximity of these cities to the Schneeberg mining district may account for the higher figures of Junghanns and Seyfarth.

In America, Jaffé of Chicago, in a series of 871 carcinomas seen at autopsy, found 11.47 primary in the lung, making pulmonary cancer second only to carcinoma of the stomach and intestines. He believes, however, that the reported increase is apparent rather than real.

It is obvious, then, that primary carcinoma of the lung is not the rare disease that it was formerly believed to be, but the question as to whether the increase is actual or apparent is still open to debate. The following observations must be taken into account. First, many tumors classified as sarcomata by pathologists of the last century are now included as epithelial tumors of the so-called oat-cell variety. Secondly, carcinoma of the lung, when found, was usually considered metastatic; this resting on the statement of no less an authority than Virchow, who stated that organs in which epithelial tumors metastasized were rarely the seats of primary carcinoma. Third, the widespread interest of pathologists in this subject, particularly in the last decade, has led to the discovery of a considerable number of small pulmonary neoplasms with large metastases; such metastases earlier observers undoubtedly regarded as the primary lesion. Clinically, there is no question that our newer methods of investigation—roentgenography with or without lipiodol, bronchoscopy, thoracoscopy, etc.—have led to frequent ante-mortem diagnoses, whereas in the early literature the diagnoses were almost exclusively post-mortem. Since external and readily diagnosed cancer has not increased, it would seem probable that, in spite of the evidence of the post-mortem figures, especially in Germany, the increase in the incidence of bronchial carcinoma in the last two decades is apparent rather than real. Our own statistics seem to agree with the others in indicating a general rise, whether or not it be an actual one.
The observations analyzed in this paper are founded on a series of 46 cases, of which 39 were autopsied at St. Luke's Hospital and one at Montefiore Home. The other cases were proved pathologically, either by bronchoscopic section or other operation. At least double this number of cases have been diagnosed as primary carcinoma of the lung, either on bronchoscopic or x-ray evidence, but not proved by section. These are not included in our statistics though they have been considered in formulating impressions of the clinical course of the disease.

Etiology

Etiologically, carcinoma of the lung must be dependent in general on the same causes as carcinoma elsewhere. As with all cancer, many theories have been advanced to account for its origin. All authors emphasize irritation of the bronchial mucous membrane as one of the underlying causes, and Mene-trier states that "in reality, inflammatory metaplasias dominate the whole history of cancer of the lung." Winternitz stressed influenza as a causative factor and actually prophesied in 1920 that, owing to the "metaplasia of the bronchial epithelium causing a proliferation of the young cells, difficult to distinguish from neoplasm, an increase in primary carcinoma would probably occur later." War gas has been mentioned, particularly by German authors. Ewing believes that tuberculosis is a common precancerous irritant. In view of the cancerogenic potency of tar, its extensive use in surfacing roads has led to speculation as to whether this might be a factor. Möller actually obtained a bronchiogenic cancer in an experimental animal by skin irritation with tar. Letulle stressed syphilis, and Jaffé found that 20 per cent of his cases gave serologic or anatomic evidence of that disease as compared with 11 per cent of the remainder of his material.

It was not until the work of Rostoski and Saupe in 1928 that the industrial disease known as Bergkrankheit was recognized as cancer of the lung, though it had been known for centuries that a large proportion of the mining community in the Erzgebirge died of a chronic pulmonary affection. Johannes Agricola, physician at Joachimstal, 1527–50, published in his book, De Re Metallica, a description of the disease. "On the other hand," he wrote, "some mines are so dry that they are entirely devoid of water and this dryness causes the workmen even greater harm, for the dust which is stirred and beaten up by digging penetrates into the windpipe and lungs and produces difficulty in breathing and that disease the Greeks call asthma. If the dust has corrosive qualities, it eats away the lungs and implants consumption in the body." Härtling and Hesse in 1879, in a single case, proved this condition to be primary bronchial carcinoma, but Rostoski and Saupe were the first to undertake careful research into the incidence of the disease among the mining population. These investigators examined in the course of three and one-half years 154 miners or ex-miners from the Schneeberg mines, in Saxony; of these, 21 died, and 13 diagnoses of lung cancer were made by post-mortem section, which means that of all persons followed until death, in the observation period, 62 per cent died of primary lung carcinoma. So common was the disease that a patient often made his own diagnosis of the dreaded Bergkrankheit from the boring pains in the chest and back, which the miners nicknamed Norgeln.
## Incidence of Carcinoma of Lung
(St. Luke's Hospital Series, 1900–1935)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Autopsies</th>
<th>Total Carcinoma</th>
<th>Total Carcinoma of Lung</th>
<th>Percentage of Carcinoma of Lung to Total Carcinoma</th>
<th>Percentage of Carcinoma of Lung to Total Autopsies</th>
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<tr>
<td>1923</td>
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<tr>
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<td>1929</td>
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<td>27</td>
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<td>726</td>
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<td>6.43</td>
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<td>142</td>
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<td>1931</td>
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<td>1932</td>
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<td>22</td>
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<td>0.18</td>
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<td>1933</td>
<td>169</td>
<td>30</td>
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<td>0.18</td>
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<tr>
<td>1934</td>
<td>186</td>
<td>34</td>
<td>3</td>
<td>0.20</td>
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<tr>
<td>1930–34</td>
<td>767</td>
<td>143</td>
<td>12</td>
<td>8.39</td>
<td>1.57</td>
</tr>
<tr>
<td>1935</td>
<td>202</td>
<td>50</td>
<td>8</td>
<td>16.0</td>
<td>3.96</td>
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<tr>
<td>Total (1900–1935)</td>
<td>3659</td>
<td>588</td>
<td>39</td>
<td>6.63</td>
<td>1.06</td>
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The length of time the disease took to develop is astonishing, and the long periods during which these miners worked after its onset are no less so. In the Schneeberg mines there is insufficient protection from dust and Rostoski and Saupe were inclined to attribute the disease to irritation from sharp particles which were inhaled. They did discover, however, that the dust was radioactive. Among 362 controls in the neighborhood who were examined clinically not one suspicious case was found. Earlier inquiries sent to Joachimstal on the other side of the mountains as to the existence of the disease had elicited the reply that it had never been observed there. In 1932, however, Pirchan and Šikl reported a similar condition in the miners of Joachimstal. This mining community, while as old as the Schneeberg on the other side of the Erzgebirge, had attracted especial attention during the second half of the nineteenth century because of its uranium deposits and later because of Madame Curie's discovery of radium in ore obtained here.

The investigation reported by Pirchan and Šikl covered the period 1929–30, and in this time 19 deaths occurred among the miners and former miners of the district. Thirteen autopsies were done and 9 cases of pulmonary cancer were found. Since 2 deaths were of a violent nature, the percentage of pulmonary cancer to natural death was 53 per cent among the mining population.

There can thus seem to be no reasonable doubt that both on the German and Czechoslovakian sides of the mountains there exists an industrial disease problem of major importance, accounting respectively for 62 and 53 per cent of the deaths among the mining population during the periods of observation. While the German investigators were inclined to consider the mechanical irritation of the dust as the primary cause, the weight of this argument is lessened by the fact that other dusty mines in Germany show no comparable incidence of pulmonary carcinoma. Silicosis is common to many mining groups, but no industrial disease similar to that among these miners of radium-containing ores on both sides of the Erzgebirge has been recorded. Furthermore, in the Joachimstal mines, where efficient respirators were in use, the incidence of pneumoconiosis was low, as shown by post-mortem evidence, though this was a common finding in the Schneeberg mines, where protection was inadequate. Pirchan and Šikl suggest that the radium contained in the dust or the emanations from radio-active particles in the inspired air may be the damaging factor, and the occurrence of the disease only among workers in mines of known radio-active ores weighs heavily in favor of this theory.

In our series of cases occupation did not play a significant part. There were no miners in the series and only 3 were engaged in dusty trades—a bricklayer, baker, and fireman. Neither were the habits of the patients of significance, except for the well-nigh universal use of tobacco. One had been a victim of war gas. Ten of the cases were in females, 36 in males.

Clinical Course

The onset of pulmonary carcinoma is sometimes exceedingly insidious, though this feature is not prominent in the present series of 46 cases. In only 10 of these could a history be elicited of over one year, though in 2 others there was a long history of asthma, in one for twenty years, in the other for the pa-
tient's life time. It cannot, of course, be determined whether in these pro-
longed histories, many of them asthmatic, we are dealing with a true asthma,
or whether the symptoms were due, part of the time at least, to cancer or
precancerous irritation of the bronchi. This contrast to the cases in the litera-
ture is especially noticeable when the present series is compared to the indus-
trial carcinoma of the lung of the Schneeberg district. In the latter group, as
a rule, there is a gradual onset, the symptoms increasing in severity over
months or years, in isolated instances from seven to twenty years. In the
Joachimstal series, also, most of the cases occurred in miners who had been
invalids for years with some chest pain or pulmonary complaint.

Fried's comment on experimental carcinoma in mice is pertinent in regard
to the probable length of time required for the development of malignant dis-
ease, which he gives as approximately one-third of the animal's life history.
Dr. Francis Carter Wood of the Institute of Cancer Research, Columbia Uni-
versity, considers this too long. In a verbal report he places the figure in
that laboratory at closer to one-sixth. Is it too much to suggest that these
observations argue for a long latent period, precancerous if not definitely can-
cerous, which in man, as in the animal, may reach a considerable proportion
of his life period? If analogies with carcinoma in animals are permitted this
long latent period may suggest that the irritant in miner's pneumonia is of a
comparatively low degree of intensity. Carcinoma of the breast and lungs in
mice may not appear until the animal has lived one-third to one-half of its
natural life, but if a powerful agent is used the time necessary for a tumor may
be as low as one-twelfth of the life cycle. Though in the Schneeberg cases we
may have the factor of continuous irritation in the presence of radio-active
dust, it is to be noted that there is great difficulty in eliciting from an acutely
ill patient in the later stages of the disease the details of a long-standing chronic
history to which he has attached comparatively little importance.

**Age Incidence**

Carcinoma of the lung is almost entirely a disease of middle and later life,
by far the largest number of such tumors occurring between the ages of fifty
and seventy. In a series of 1888 cases collected by Fischer it was found that
only 13 per cent had been seen in patients under forty, while one-third oc-
curred in the fifth decade, and another third after the age of sixty; four tu-
mors were found in children under ten years of age and one at ninety-nine
years.

The ages of our patients ranged from seventeen to sixty-nine, as follows:

<table>
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<tr>
<th>Age Range</th>
<th>Number of Cases</th>
</tr>
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<tbody>
<tr>
<td>10–20</td>
<td>1 case</td>
</tr>
<tr>
<td>20–30</td>
<td>3 cases</td>
</tr>
<tr>
<td>30–40</td>
<td>5 cases</td>
</tr>
<tr>
<td>40–50</td>
<td>6 cases</td>
</tr>
<tr>
<td>50–60</td>
<td>17 cases</td>
</tr>
<tr>
<td>60–70</td>
<td>14 cases</td>
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</table>

Cases occurring in early childhood or infancy have long aroused interest
and discussion. Schwyter reported an adenocarcinoma of the lung in a six-
teen-months-old child. The patient became ill two months before her death, with loss of appetite and pallor. The left half of the thorax was entirely obscured by an effusion and there was extreme dyspnea. Death was due to diphtheria, and at autopsy the left lung was found to be invaded by a large mucoid tumor which extended diffusely through the parenchyma, leaving only a little atelectatic pulmonary tissue posteriorly. There were metastases in the hilus nodes. The microscopic sections of this tumor showed it to be composed of high cuboidal or cylindrical epithelium without cilia. There was every indication that this was a primary tumor of the lung and followed the clinical course as well as showing the pathological picture which is so much more frequently seen in older subjects. Schwyter states that the earlier literature regarding such tumors in infancy consists mostly of very doubtful cases and none was found similar to his own. Steffen cites the cases of Curran, of Rolleston and Trevor, and of Nuscheler, which he believed gave every indication of being primary tumors. More recently reported cases, as those of Beardsley, Lereboullet, Garnier and Courtial, Cathala and Ducas, of extensive tumors with massive pleural effusions in children of sixteen months, five years, ten years, and four years, respectively, were either lymphosarcoma or small-cell carcinoma, the histological description of these tumors being insufficient to distinguish between the two groups.

Although the present series of 46 cases contained no instance of a tumor in infancy, it includes one boy of seventeen (Case XXIX) with a large papillary tumor of the right upper lobe which was locally malignant and hence is included here as a carcinoma. This tumor might be diagnosed by some pathologists as a papilloma, because of the fairly uniform size of its minute nuclei and their arrangement in somewhat regular layers and folds, together with the fact that metastases were not found at autopsy. There is a possibility that it originated as a papilloma of the bronchus. It had so completely destroyed the wall of the secondary bronchus and other adjacent bronchi that no trace of normal structure remained. We therefore believe that it is justifiable to consider it a malignant tumor. We have found no instance of a papilloma of this size in the literature.

Fischer observed in his own series of 62 cases 2 in the third decade, and Wildbolz found the same number among 94 carcinomata in persons under thirty years of age. In the 1588 cases of pulmonary carcinoma collected by Fischer from the literature the proportion for the third decade, was 2 per cent, while our series showed 6.5 per cent for this age period. These figures are sufficient to indicate the rarity of carcinoma of the lung under the age of forty. It is, however, characterized by the same clinical and pathological course in this age group as in more elderly persons.

Pathology

Location of the Tumor

It has long been noted that primary tumors of the lung are somewhat more frequent on the right side than on the left. In a series of 3735 cases quoted by Fischer it was found that approximately 53 per cent occurred on the right, 45 per cent on the left, and slightly less than 2 per cent were bilateral.
With regard to the site of origin, Fischer reports on a series of 784 cases. Of these, 142 arose in the right main bronchus and 115 in the left. The lobes were involved in the following order:

- Right upper lobe: 148 times
- Left upper lobe: 130 times
- Right lower lobe: 129 times
- Left lower lobe: 105 times
- Middle lobe: 15 times

In our series 8 tumors, or 17 per cent, involved the main bronchus. In 2 cases it was impossible to ascertain the exact site of origin, because of restricted autopsy, while one was bilateral and 2 were peripheral. In the remaining 33, the lobes were involved as follows:

- Right upper lobe: 15 times
- Left upper lobe: 6 times
- Right lower lobe: 5 times
- Left lower lobe: 7 times

It is often impossible to designate which bronchus gives rise to a tumor, especially if the growth is large or necrotic, and dogmatic statements have frequently been made not wholly justified by the autopsy or even the roentgen or
bronchoscopic findings. Not infrequently a tumor arising in a secondary bronchus may, as it enlarges, erode and infiltrate the wall of a main bronchus or even of the trachea, which thus appears from the bronchoscopic point of view to be the primary site. Early atelectasis of a lobe is undoubtedly a fairly trustworthy index to the point of origin of a small growth, but in many of the tumors coming to autopsy the massive destruction entirely precludes the possibility of forming any conclusion as to the bronchus first involved. Certainly in the case of the peripheral tumors, which simulate pleuritic or metastatic growths, or of the nodular tumors in the parenchyma, it is impossible to decide whether the point of origin is in a secondary or tertiary bronchus or a bronchiole.

Special interest attaches to tumors arising in one of the main bronchi because of the early involvement of the entire lung by the tumor, or by bronchitis, pneumonia, atelectasis, or suppuration and bronchiectasis. As stated above, 8 of this group, or 17 per cent, appeared to arise from a main bronchus, thus involving both lobes of the adjacent lung either with tumor or its infectious complications.

**Gross Pathology**

The varied picture presented by primary bronchiogenic carcinoma permits of classification in a number of groups. Classifications may be made either on an anatomical or a descriptive basis, but since the question of treatment is
becoming a more important one, the anatomical and histological features are the only ones which possess significance. It appears most practical to recognize five types, their frequency in our series being as follows:

1. Central or hilus type .......................... 49.7%
2. Nodular parenchymatous ...................... 17.8%
3. Peripheral ..................................... 6.5%
4. Diffuse ......................................... 23.9%
5. Bilateral miliary ................................. 2.1%

These anatomical forms have often been described, in a pictorial sense, by various terms. The central type (Fig. 1), for instance, is by some authors described as nodular massive. The term nodular parenchymatous corresponds to the intermediary or circumscribed form of Huguenin, designating a tumor situated within the center of a lobe and shown roentgenologically to be entirely separated from either the hilus or the pleura (Fig. 2). This tumor may be very small and only after repeated roentgenograms does it become evident that the growth is probably a primary pulmonary one. The metastatic growth in the brain may dominate the clinical picture, as in Case XL (Fig. 3). The peripheral tumors arising in a bronchiole near the surface, spreading over a large area of cortex and involving the subpleural lymphatics with no solitary nodule are referred to by Letulle as latent carcinoma or pachypleuritic carcinoma, and by Huguenin as pleural.
The diffuse group includes those tumors frequently referred to as pneumonic, since they usually involve an entire lobe or even a whole lung, and present a grayish consolidated surface closely resembling the gray hepatization of lobar pneumonia. This form of tumor is frequently obscured by a massive pleural exudate, so that often the anatomical features can be ascertained only at autopsy. Even if the hemorrhagic effusion can be partially removed from the pleural cavity, a widespread opacity usually remains (Fig. 4). It is usually impossible to separate the peripheral and the diffuse tumors from the so-called endothelioma of the pleura, except by the microscopic features.

Concerning the bilateral miliary form there has been much controversy, since the gross and roentgen appearance may exactly simulate that of a metastatic growth, such as that of Pick, which arose in an adenocystoma of the ovary. The case of Briese was undoubtedly primary in the lung, and Fischer recognizes this as one of the forms of primary lung tumors, but believes that the appearance of the nodules is such that a multicentric origin, a theory accepted by Letulle, is possible. Weissmann, reporting two cases and citing 5 others, assumes an origin from fetal remnants of alveolar lining epithelium. Hedinger also reported a case, in a man twenty-five years of age. In our own series Case XXIII (Figs. 5 and 6) is of this type, a diffuse involvement of both lungs occurring apparently simultaneously and proving to be the primary tumor with tall columnar cells and papillary arrangement. The diagnosis of this form and its differentiation from tuberculosis have been recently discussed by Hamman.
FIG. 5. BILATERAL MILIARY PRIMARY ADENOCARCINOMA. CASE XXIII
See also Fig. 23.

FIG. 6. BILATERAL MILIARY NODULES OF PRIMARY PULMONARY ADENOCARCINOMA. CASE XXIII
There is general agreement that the hilus type is the most frequent, the incidence varying according to different authors from 90 per cent, estimated by Boyd, to 76 per cent by Jaffé.

Because of the frequency with which the main bronchus is the site of origin of these tumors—17 per cent in our series—they often become advanced before they are detected, being obscured by the normal mediastinal shadows. Such tumors frequently lead to atelectasis of a whole lobe, as in Case XLIV (Fig. 7), or if stenosis takes place early, to bronchiectasis and in rare instances to multiple large abscesses, as in Case XIV (Fig. 8).

Another clinical form of the hilus tumor is the superior sulcus growth (Fig. 9), which, as it affects the main bronchus to an upper lobe, frequently erodes the vertebral bodies and the first rib, involves the sympathetic trunk, and often produces a Horner syndrome and other neurological symptoms. This tumor was described first by Hare and recently by Pancoast, who discussed the clinical syndrome and roentgen picture in 7 cases, but without the post-mortem findings. Pancoast's interpretation is that these tumors possibly arise from remnants of one of the branchial pouches, but this is not accepted as probable by most writers. Steiner and Francis, who described three superior sulcus tumors with two autopsies, found that the primary tumor as well as the metastases presented the histological characteristics of the undifferentiated or polymorphous type of lung tumor rather than the squamous structure which would be present if the tumors had originated in the branchial pouches. Jacox reported two additional cases, in one of which autopsy was

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**Fig. 7. Atelectasis of Left Upper Lobe due to Tumor in Main Bronchus to This Lobe.**

*Case XLIV*
done, showing glandular and mucus-producing cells in the primary tumor and squamous differentiation in the adrenal metastases. Connolly added another instance of such a tumor primary in the bronchioles and composed histologically of adenocuboidal cells. Cases XX and XXXVII illustrate this syndrome, the first being a squamous tumor, the second a cuboidal-cell type. Both were treated with x-rays with scant benefit.

The most frequent form of hilus tumor is that which grows outward in a radiating fan-shaped mass, spreading along the peribronchial lymphatics and forming around them a sheath of tumor cells which appear as heavy radiating peribronchial shadows in the roentgenogram. The intrabronchial form of this tumor cannot be considered a separate entity, as in its earliest stages it is almost certain to invade a bronchus at some point and there may form a small papillary growth, as in Case XVIII (Fig. 10).

The nodular parenchymatous form appears often in the center of a lobe, probably most frequently in the lower border of the upper lobe or in the lower lobe (Fig. 11), and here simulates a cyst, a metastatic or benign tumor, an abscess or a localized area of confluent bronchopneumonia, from which it may be differentiated only after considerable observation. There may be very few pleural adhesions and no effusion in the chest. If such a nodule undergoes central necrosis, as is frequently the case, it may closely simulate a caseous tuberculous nodule. It may remain small, while a metastasis in some vital
organ, as the brain, may be the immediate cause of death, or the tumor may assume a huge size and cause relatively few symptoms and late metastases as in Case XXXV. Tumors in this position cannot always be assumed to be of the adenocarcinoma or cuboidal-cell type. In one case in our series, Case XL, this nodular tumor was composed of cuboidal or large undifferentiated polymorphous cells, while in another, Case X, the tumor, near the periphery and drained surgically as an abscess, was made up of highly differentiated squamous cells. Tumors of this type are estimated by Jaffé to form not over 6 per cent of the total.

A larger number, about 13 per cent according to Jaffé, constitute the peripheral or pleuritic group. Huguenin and Letulle recognize this form of primary lung tumor, but Fischer does not refer to it. Fried regards it as one stage in the progress of a more centrally placed primary tumor. Since, however, it is frequently impossible at autopsy to determine any single primary parenchymatous focus which essentially involves the pleural surface and subpleural alveoli, as a matter of convenience these tumors are here separated from the rest. Three tumors in our series presented this picture, Cases XXII, XLI, and XLVI.

**Metastases**

It has long been accepted that carcinoma of the lung is one of the tumors which metastasizes most widely, involving organs not frequently affected by
tumors arising elsewhere, as for example the suprarenals and the brain. A non-metastasizing primary lung carcinoma is scarcely to be expected. Unquestionably the statistics given cannot be entirely accurate, since the number of organs examined at autopsy is not identical even in any one series, and many of the reports do not differentiate between partial and complete autopsies. The proportion of cerebral metastases, especially, is still unknown. Of late years such metastases are being diagnosed with considerable frequency by neurological surgeons. Patients with cerebral symptoms are referred for brain surgery and on careful radiological study are found to have a primary pulmonary growth. By combining statistics from this source with those from general hospitals, an accurate estimate of the incidence of cerebral metastases will eventually be obtained. A striking example of a metastatic brain tumor being mistaken for a primary growth is recorded by Fried. The patient was operated upon in 1922 for a primary cortical cerebral growth; a second operation was done for a recurrence in the same year, with complete recovery until 1928, when the primary tumor in the lung became evident and caused death.

According to Fischer, the gross statistics show metastases in some situation in 80 per cent of the cases, but this figure is undoubtedly too low. Briese
believes the incidence to be as high as 93 per cent, while Fried in a series of 47 cases found multiple metastases in all but three. It is probable that the situation is comparable to that in the skin, that is, all the squamous-cell tumors will eventually metastasize, and even among the basal-cell group occasional metastasis will take place from both lung and skin. In our series of 46 cases, all but one, i.e. 97.4 per cent, showed metastases, at least to the regional nodes. The one exception was the papillary tumor in Case XXVIII, which, in its histology, as well as in the absence of metastases, is perhaps comparable to the basal-cell tumors elsewhere. Although forming a large mass, it had not metastasized. Next to the peribronchial or hilus nodes, the liver is given as the most frequent site of metastasis in all series. Of the 39 cases in which the liver was examined in our series 19 or 48 per cent showed metastases.

According to Miller and Jones, the frequency of metastases in 808 cases collected from the literature is as follows:

<table>
<thead>
<tr>
<th>Tissue</th>
<th>Cases (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleura</td>
<td>285 (35.2%)</td>
</tr>
<tr>
<td>Lymph nodes</td>
<td>245 (30.0%)</td>
</tr>
<tr>
<td>Liver</td>
<td>248 (30.0%)</td>
</tr>
<tr>
<td>Lung</td>
<td>173 (21.0%)</td>
</tr>
<tr>
<td>Kidneys</td>
<td>122 (15.9%)</td>
</tr>
<tr>
<td>Bones</td>
<td>88 (10.1%)</td>
</tr>
<tr>
<td>Suprarenals</td>
<td>79 (9.7%)</td>
</tr>
<tr>
<td>Brain</td>
<td>77 (9.5%)</td>
</tr>
<tr>
<td>Heart and pericardium</td>
<td>22 (2.7%)</td>
</tr>
<tr>
<td>Pancreas</td>
<td>12 (2.0%)</td>
</tr>
<tr>
<td>Gastro-intestinal tract</td>
<td>9 (1.1%)</td>
</tr>
<tr>
<td>Thyroid</td>
<td>8 (1.0%)</td>
</tr>
<tr>
<td>Spleen</td>
<td>6 (0.7%)</td>
</tr>
<tr>
<td>Muscles</td>
<td>2 (0.2%)</td>
</tr>
</tbody>
</table>

In the present series a slightly different distribution was found, as follows:

<table>
<thead>
<tr>
<th>Tissue</th>
<th>Cases (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nodes</td>
<td>41 (97.4%)</td>
</tr>
<tr>
<td>Lung</td>
<td>10 (25%)</td>
</tr>
<tr>
<td>Suprarenals</td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>10 (25%)</td>
</tr>
<tr>
<td>Left</td>
<td>8 (20%)</td>
</tr>
<tr>
<td>Both</td>
<td>6 (15%)</td>
</tr>
<tr>
<td>Bones</td>
<td>11 (27.5%)</td>
</tr>
<tr>
<td>Brain</td>
<td>(3 out of 5 examined)</td>
</tr>
<tr>
<td>Heart</td>
<td>2 (5%)</td>
</tr>
<tr>
<td>Peritoneum</td>
<td>3 (7.5%)</td>
</tr>
<tr>
<td>Skin</td>
<td>3 (7.5%)</td>
</tr>
<tr>
<td>Ovary and uterus</td>
<td>2 (5%)</td>
</tr>
<tr>
<td>Kidney</td>
<td>3 (7.5%)</td>
</tr>
<tr>
<td>Pancreas</td>
<td>1 (2.5%)</td>
</tr>
<tr>
<td>Bladder</td>
<td>1 (2.5%)</td>
</tr>
<tr>
<td>Spleen</td>
<td>2 (5%)</td>
</tr>
<tr>
<td>Prostate</td>
<td>1 (2.5%)</td>
</tr>
</tbody>
</table>

Dosquet, under the direction of Lubarsch, studied the incidence of central nervous system and suprarenal metastases in a series of 109 cases of pul-
monary and bronchial carcinoma, comparing these with 2519 cases of carcinoma of other types which had also been autopsied in the pathological laboratories in Berlin and Kiel. It was found that the lung tumors metastasized to the central nervous system in 31.4 per cent of the cases, and to the suprarenals in 21.8 per cent. Of the other cases of carcinoma the metastases to the central nervous system amounted to 1.6 per cent in the Berlin material and to 0.06 per cent in the material from Kiel, while the suprarenal metastases in these institutions were, respectively, 2.6 and 3.9 per cent.

Metastases to the suprarenals comprise a considerable proportion of the total number, particularly in the more recently reported series of cases, in which they have received special attention. Undoubtedly they have in the past frequently been considered primary tumors since they are often of the polymorphous type and therefore resemble the ganglioneuroma, far from suggesting any resemblance to the bronchial mucosa. In the 808 cases summarized by Miller and Jones the suprarenals were involved in 9.7 per cent, while in the 100 cases studied microscopically by Jaffé there were 42 per cent with suprarenal metastases. Fried found them to be extremely frequent, and Arkin and Wagner in 135 cases studied at autopsy showed 43 per cent with metastases to the adrenals. In our series of 43 autopsies the right suprarenal was involved in 24 per cent, the left in 19 per cent, and both in 14 per cent. These figures show conclusively that no other tumor metastasizes to the adrenal with a frequency at all comparable to the bronchial carcinomas. Such metastatic tumors may reach a huge size, as in the case reported by Nussbaum, in which the metastatic growth was 15 cm. in diameter.

According to Fischer, the incidence of bone metastases is perhaps a little greater than of metastases to the kidneys, varying from 20 to 33 per cent in the literature. Metastases have been reported in many parts of the skeletal system. Roussy and Huguenin observed a predilection for the flat bones, while Seyfarth found the sixth and seventh cervical vertebrae most often involved. Atkin reports metastases in the upper end of the femur and humerus, and Hochstetter found a metastatic tumor in the shoulder blade. In our series the ribs, skull, sternum, lumbar spine, ilium, tibia, and metacarpal were the bones in which tumor was identified.

**Histogenesis**

It is now almost universally accepted that the cells of pulmonary carcinoma are derived from the mucous membrane of the bronchi or bronchioles. Even within a few years reports have appeared in which an origin from the lining cells of the alveoli was assumed, but following the studies of Seeman, Letulle and others, it appears to have been satisfactorily shown that the lining cells of the alveoli are mesodermal and that the changes which they assume under many inflammatory, irritative, and metabolic conditions are those of swelling and hyperplasia, due to their phagocytic and metabolic functions. The fact that many pulmonary carcinomata have been found replacing the normal lining cells and surrounding the air spaces with a single layer of tall columnar cells has led to the designation alveolar-cell tumor. This arrangement is also seen in secondary tumors of the lung and is apparently only an
adaptation of the tumor to the anatomical structure of the lung, providing the
cells with a foothold and vascular supply which enable them to grow over the
lining of the air sac.

Maximow states that our knowledge of the development and fate of the
cuboidal epithelium lining the vesicles of the embryonic lung is still incom-
plete, but favors the idea that the lining cells in the adult aerated lung are
mesenchymal, and accepts in vivo experiments which may be carried out upon
the cells in the septa, demonstrating the characteristics which show them to be
macrophages or histiocytes. The free phagocytic cells containing hemosiderin

and seen in the chronic passive congestion of cardiac disease probably arise
from the non-granular cells of the blood stream.

The lining of the bronchi consists of columnar ciliated cells, between which
are goblet cells, thus forming the pseudo-stratified respiratory epithelium.
Mucous and mucoserous glands are found in all portions of the bronchial tree
containing cartilage. This affords three adult modifications of lining epi-
thelium, from which cuboidal, mucus-producing, or papillary adenocarcinoma
may arise.

Cell Types

The number of groups of pulmonary carcinoma which may be recognized
histologically varies according to different writers, Huguenin and Letulle recog-
nizing only three, while Jaffé prefers six, Fried five, and Fischer eight. It
seems to us preferable to accept the simpler classifications, even though in the undifferentiated group there will always be certain tumors for which separate subdivisions might be made. In general, the principles of Weller and Samson and of Karsner seem entirely adequate. Our cases are thus grouped.

(1) Squamous.
(2) Adenocarcinoma.
(3) Undifferentiated carcinoma.

(a) Carcinoma simplex, including the polymorphous types with large giant cells, medullary types with small oval cells, cuboidal and cylindrical cells without acinus formation, and basal cells.
(b) Small spindle-cell, or so-called oat-cell, and round-cell types.

The squamous type of cell was found in 14, or 30.4 per cent, of our 46 cases. The morphology varies. In some keratinization with extensive central softening and necrosis is prominent, and there may be well developed intercellular bridges, as in Case X (Fig. 12), or the malpighian layer may predominate, as in Case XXVI (Figs. 13 and 14). More frequently the differentiation is less complete and only small imperfect pearls, as in Case XXXIV (Fig. 15), and groups of pavement cells with early keratinization, as in Case X (Fig. 16), indicate the metaplasia which is in progress. Transitional cells may alternate with any of these forms (Fig. 17). In a biopsy specimen it is
FIG. 13. **Malpighian Layer Predominating in Some Areas. Case XXXVI.  \times 175**

FIG. 14. **Further Squamous Characteristics. Case XXXVIII.  \times 210**

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this structure which is often the clue to the source of the primary tumor, as a tendency to squamous metaplasia is rare in metastases from other internal organs. Among our 14 squamous tumors metastases were found in the peribronchial nodes in all the autopsied cases, in the cervical nodes in two, and in the pleura, ribs, ilium, spine, axillary nodes, liver and adrenal. An extensive local spread may take place in this group, infiltrating the pericardium and pulmonary vein, and constricting the superior vena cava and the pulmonary artery. These tumors also metastasize to the brain, as shown by many authors, in 33 per cent of 74 tumors (according to Arkin and Wagner).

Squamous tumors may arise in any portion of the lung, and are not necessarily situated at the hilus. As Samson has stated, morphology has nothing to do with the level of origin, i.e., squamous, columnar, or undifferentiated tumors are not found exclusively in any one location. Half of our squamous tumors originated outside the hilus, and one which arose near the periphery metastasized to the pleura of the affected lung near the hilus. Neither is age a certain index to cell morphology, for although squamous tumors are more common after the age of fifty, we have observed one at forty and another at forty-five. Geschickter has recently emphasized the general principle of correlation between squamous-cell tumors and the older age group, as pointed out by Atkin.

The adenocarcinomas, 12 of which occurred in the St. Luke's material, constituting 26 per cent of the series, include those tumors which show definite
Fig. 16. Keratinization in small areas. Case X. × 140

Fig. 17. Transitional-cell areas. Case X. × 175

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FIG. 18. ADENOCARCINOMA WITH WELL FORMED GLANDS. CASE XXXV. × 175

FIG. 19. EPITHELIAL CELLS REPLACING LINING CELLS OF ALVEOLI IN ADENOCARCINOMA. CASE XXXV. × 175

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palisading around a central glandular lumen (Figs. 18 and 19), a tendency to replace the lining cells of the pulmonary alveoli (Fig. 20), or to form throughout low columnar cells, usually with the production of considerable amounts of mucus. It is perhaps not wholly possible to separate this group from the so-called cuboidal and transition forms, one of which, Case XXXVII, is included in our list of undifferentiated tumors (Fig. 21). Small areas from one portion of the tumor may appear definitely cuboidal, while in some other portion of the primary growth or metastatic deposits the cells may be much more detached and no true glands may be detected.

Included with the adenocarcinomas are the tumors formerly described as mucous-cell carcinoma (Fig. 22), since we believe that, as the mucous cells lining the bronchi have taken their origin from the same covering epithelium as that of the bronchi, and are merely a more specially differentiated form of the same cells, no group distinction should be made between the columnar cells and the mucous cells. It is of considerable interest, nevertheless, that the same high degree of differentiation may take place in metastases, as in Case IV, in which the lesions in the adrenal and metacarpal bone showed the same highly differentiated mucus-producing cells.

Of special interest is the bilateral miliary tumor in Case XXIII. The cells of this tumor were unusually tall columnar cells, secreting fairly large amounts of mucus (Fig. 23). A similar tumor described by Geschickter had an adenomatous arrangement of cuboidal cells in the primary growth, but the
Fig. 21. Cuboidal Cells in Metastasis. Case XXXVII. × 175

Fig. 22. Adenocarcinoma Showing Mucous-cell Structure. Case IV. × 400
metastases in the bones showed squamous characteristics. No such differentiation toward a squamous morphology was seen in our case. In this type of tumor single lobules appear to be distended and filled with glairy, grayish, mucus-producing cells distributed throughout both lungs.

The adenocarcinomata are among the most rapidly growing and widely metastasizing of the lung tumors, all of them showing metastases in nearly every series of cases. Arkin and Wagner found 48 per cent of 74 cases metastasizing to the bones. It is this type which forms the peripheral growth resembling endothelioma of the pleura as in Cases XLI (Fig. 24) and XXXV

Fig. 23. Adenocarcinoma, Bilateral Miliary Type, with Very Tall Mucus-producing Cells. Case XXIII. × 160

(Fig. 25). It has often been described as an alveolar-cell cancer (Sweaney). Through its rapid extension by direct implantation and by the lymphatics, whole lobes or even a whole lung may become involved, and as it consolidates, it closely resembles the gray hepatization of lobar pneumonia, thus forming the so-called pneumonic form of carcinoma.

The largest group of lung carcinomas is made up of the undifferentiated types, which comprised 19, or 41 per cent, of our series, as follows:

<table>
<thead>
<tr>
<th>Type</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oat-cell</td>
<td>4</td>
</tr>
<tr>
<td>Small-cell</td>
<td>7</td>
</tr>
<tr>
<td>Cuboidal-cell</td>
<td>3</td>
</tr>
<tr>
<td>Polymorphous</td>
<td>4</td>
</tr>
<tr>
<td>Basal-cell</td>
<td>1</td>
</tr>
</tbody>
</table>
Karsner and Saphir make no important distinction between the small-cell and the oat-cell types, stating that one or the other type of cell may predominate in different parts of the same tumor and its metastases. This is in agreement with the cases studied here, although the elongated elliptical cells tend to predominate in some tumors (Figs. 26 and 27) while in others or in metastases of the same tumors the cells are almost entirely spherical (see liver and spleen metastases in Case XLVI, Figs. 28 and 29). Fischer describes these small cells as about twice the diameter of a red cell and very closely resembling lymphocytes. It has long been said that the Schneeberg lung cancers were of this type, but Schmorl's examination of 23 cases showed that only three of them contained small cells. Pirchan and Sikl describe all types.

These small-cell tumors closely resemble lymphosarcoma (Fig. 30) and undoubtedly in many instances have been so designated in autopsy statistics, since both the nuclear structure and bulky metastases in the lymph nodes create a gross picture almost identical with that of lymphosarcoma. It is stated by Karsner that the massive metastases of these tumors in the nodes in the upper posterior mediastinum are usually associated with anterior displacement of the trachea. They also rapidly spread to the abdominal nodes, 50 per cent metastasizing to the abdomen in some series. Bone and brain metastases are only slightly less frequent, according to Karsner, but according to Fried the round-cell type does not metastasize to the central nervous system (p. 49). Arkin and Wagner found 16 per cent of 74 cases of the round-cell type with central nervous system metastases.

Even in tumors composed chiefly of minute spherical cells one finds some of the giant multinucleated cells in the primary growth, indicating that these are undoubtedly degeneration forms. The polymorphous group, therefore, is to be regarded only as a slight morphological variation from the other undifferentiated tumors. They possess the same biological characteristics and metastasize widely both to the chest and to more remote organs. The giant
FIG. 25. SUBPLEURAL INVASION OF CELLS. CASE XXXV. × 175

FIG. 26. OAT-CELL TYPE OF TUMOR, ELLIPTICAL CELLS. CASE II. × 350
nuclei seen in this polymorphous group appear to be most frequent in the suprarenal metastases (Fig. 31), but are often found in the primary tumor as well, as in Case XL (Fig. 32). These large cells present some question as to diagnosis, but Masson stains indicate that they are epithelial, associated with very little stroma, and the form of the giant cells is the same as those sometimes seen in poorly nourished areas even in the small-cell group.

The cuboidal types possess much larger rounded or irregular nuclei, often growing in the form of delicate strands and thus slightly suggesting a papillary or adenomatous structure. These tumors metastasize widely and are not infrequently detected in the axillary or cervical nodes when a biopsy is done.

![Fig. 27. Medullary Areas in Oat-Cell Tumor. Case XLVI. × 150](image)

The one basal-cell tumor in the series, Case XXVIII (Fig. 33), was a solitary, non-metastasizing growth and presented unusually interesting cell structures, being composed of small spherical nuclei, apparently derived from the undifferentiated cells lining the bronchioles, but with a slight suggestion of prickle-cell arrangement and a tendency to form flat plates which, although not keratinizing, spread out to form small sheets. This morphological structure lacks entirely the medullary character of the other undifferentiated tumors and occupies a unique position in this series, possessing the characteristics of limited invasion, lack of metastasis, and no capacity to differentiate, i.e., ent-differentiation, as Weller expresses it.

Another example of failure of cells to differentiate is the tumor often described as medullary (Case XXXIII, Fig. 34), a highly malignant cellular tumor with small vesicular nuclei. This grows in broad sheets, often with much necrosis, and shows a regular tendency to invade blood vessels (Figs. 35 and 36).
FIG. 28. Metastasis to Liver, Oat-cell Tumor. Case XLVI. $\times 600$

FIG. 29. Metastasis to Spleen, Oat-cell Tumor. Case XLVI. $\times 600$
Associated Chest Lesions

Fried has reviewed the literature regarding the association of tuberculosis and pulmonary carcinoma and does not believe that the coincidence is very rare. He reported 13 cases in which both lesions were present in the same lung, the infection usually being in the healing fibrotic stage. Seyfarth found some chronic tuberculosis in 15 per cent of his patients with pulmonary carcinoma. In 6 per cent the two were closely associated. Eight of our patients, or 18.6 per cent, had tuberculosis; in 5 the lesions were active, in 3 healed.

Carcinoma of the bronchi readily invades the other mediastinal structures, much more often than any other growth. In the present series the pericardium was invaded in 7 cases, the ventricular muscle in 1, and the great vessels were infiltrated, surrounded, or narrowed in 11 instances.

Bronchitis, bronchopneumonia, abscesses, and atelectasis were frequently present, and in a few cases gangrene of the lung. Large amounts of clear, hemorrhagic, or opaque greenish fluid were found in the affected pleural cavity in about half the cases; in a few equal or larger amounts of fluid were present on the opposite side.

Summary of Pathological Features

Pulmonary tumors are essentially bronchiogenic and their morphology varies according to the type and degree of differentiation assumed by the lining cells of the bronchi or bronchioles. Grossly they may be classified as hilus tumors, nodular parenchymatous, peripheral, diffuse, or bilateral miliary lesions. Microscopically we have classified them in three groups as squamous,
adenocarcinoma, and undifferentiated, the latter including small round-cell, oat- or spindle-cell, medullary, and basal-cell types.

Metastasis ultimately takes place with each of these types, practically 100 per cent to the peribronchial nodes. Widespread metastases are the rule in the adenocarcinomas, and massive mediastinal metastases in the medullary and small-cell types.

**SYMPTOMS**

The symptoms of bronchial carcinoma are protean in character, depending on the situation and stage of the lesion. Tumors located in the primary bronchi cause cough, as in Case XXVI of our series, and often hemoptysis, while those centrally located in the lung tissue may give no pulmonary symptoms whatever, as in Case XXVIII, in which the sole complaint was a progressive osteoarthropathy. Again, the first symptom may be due to a metastasis elsewhere in the body, as in Case IX with a metastatic carcinoma of the tibia, Case III with secondary deposits in the liver, and Case IV with a brain metastasis. Symptoms attributable to the lung lesion itself are diverse, depending on the type of the pathological process.

The two most constant symptoms are cough and pain. Cough was present in 91 per cent of our series and was the first symptom in 23.81 per cent. Of the irritative variety in the beginning, it gradually becomes more

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**FIG. 31. UNDIFFERENTIATED POLYMORPHOUS-CELL TYPE METASTATIC IN ADRENAL. CASE XL. X 300**

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constant, and is accompanied by expectoration, at first of glairy mucus, then mucopurulent, and finally purulent. With abscess formation the sputum is foul and fetid. As pointed out above, with lung lesions centrally located, as in Case XXVIII, cough may be absent altogether. Pain shares with cough the distinction of being the earliest and most common symptom. In 21.73 per cent of our cases it was the first evidence of the disease. It was present in 71.73 per cent of our 46 cases. Often it is at first merely a vague sense of boring and oppression, frequently unrelated to the location of the tumor and very similar to the “Norgeln” of the Erzgebirge miners. Later it may be more intense, sometimes excruciating, and with the advent of pleurisy it as-

![Fig. 32. Undifferentiated Polymorphous Giant-cell Type in Lung. Case XL. × 210](image-url)

sumes a pleuritic character. Asthmatic breathing was the first symptom in 10.86 per cent of the series and is a common complaint due to bronchial occlusion of greater or less degree. Dyspnea, apart from asthma, may be caused by either replacement of a large part of the alveolar cavity by tumor tissue or by tumor of miliary distribution, as in Case XXIII, in which it was the first symptom, or more commonly by pleural effusion, atelectasis, or pressure by mediastinal lymph node metastases on the trachea, bronchus, or heart. Loss of weight and strength, though usually occurring later, were the first symptoms noted in 6.52 per cent of our cases. Osteoarthropathy was the initial complaint in 3 cases. Fever occurred in 54.34 per cent of our patients. It is invariably present with abscess formation or secondary inflammation, and in most other cases is present at some stage of the disease, even in the absence of
evidence of inflammation. Its cause in the latter case is obscure, but it may be noted that it is frequently present, also, in primary carcinoma of the liver. Hemoptysis is often an early symptom and is sometimes frequently repeated. It occurred in 30.43 per cent of our cases. We have seen nothing distinctive or characteristic about it and have failed to observe the so-called "current jelly" type.

Physical signs of bronchial carcinoma are likewise protean. There may be complete absence of signs in the early stage, giving way to a localized bronchitis and x-ray evidence of slight peribronchial infiltration after a few months. In the later stages of the disease there may be dulness, bronchial

![Fig. 33. Basal-cell Tumor Consisting of Papillary Masses of Small Basal Round Cells and Beginning Flat Plates of Squamous Cells without Prickle-cell Formation. Case XXVIII. × 200]

voice, bronchial or diminished breath sounds due to the tumor or to atelectasis of either a lobe or the whole lung, and displacement of the mediastinum and diaphragm. Abscess formation or pleurisy with effusion may mask the physical signs. The discrete isolated pulmonary tumor may give no physical signs or slight dulness and diminished breathing with a characteristic x-ray picture, in which case the differential diagnosis must be made between the malignant and benign tumor or cyst. The two most helpful adjuvants are roentgenography and bronchoscopy. The former presents, according to the stage of the disease, no shadow, a picture of peribronchial infiltration extending from the hilus in early cases, a dense shadow involving the lobe in the scirrhous type of growth, or an advancing atelectasis, sometimes involving the whole lung when both main stem bronchi are involved. The picture of a mediastinal mass is perhaps the commonest. There may be a dense opacity due to fluid, a discrete circumscribed shadow of an isolated lesion, or innumerable small
Fig. 34. Medullary Undifferentiated Carcinoma with Small Oval Nuclei.
Case XXXIII. × 760

Fig. 35. Same Tumor as in Fig. 34, Showing Invasion of Large Blood Vessel. × 175
shadows resembling tuberculosis of the miliary type. The injection of iodized oil (lipiodol) is much stressed, particularly by French observers, who point out that the oil shadow surrounds the shadow due to the tumor but does not penetrate it.

Bronchoscopy is the most reliable method of diagnosis, as many cases of carcinoma of the lung are of the bronchial type. The lesion is often situated near the opening of one of the main stem bronchi, and is accessible not only to inspection but also for the removal of a fragment for pathological examination. Pressure upon a bronchus causing narrowing but without a lesion of the mucosa may also be demonstrated. Where the lesion is lower down in the bronchial tree this type of examination gives no information. It also fails to reveal discrete tumors within the lung.

![Image](image.jpg)

**Fig. 36. Same Tumor as in Fig. 34, Showing Large Tumor Embolus in Vein. × 760**

Thoracoscopy may be of value in establishing a diagnosis and also in determining the possibility of a successful operation. One or two of our cases have been saved by this means from an unnecessary operation.

From the above brief description it is obvious that any one of the symptoms or physical signs of pulmonary carcinoma, and many of their combinations, may be equally well caused—and, as a matter of fact, are more frequently caused—by other diseases than carcinoma. It is, therefore, only by a careful evaluation and exclusion of other diagnoses that a correct conclusion may be arrived at. Of the 46 pathologically proved cases of carcinoma of the lung seen in the service at St. Luke's Hospital from 1900 to 1936, 36 were correctly diagnosed before death. In 4 a diagnosis of abscess of the lung was made. In the remainder, various diagnoses were made, such as metastatic carcinoma of the tibia, mediastinal tumor, brain tumor, carcinoma of the liver,
general carcinomatosis, teratoma or cyst of the lung, endothelioma of the pleura, etc. Since 1924, in which year several cases came to autopsy, the correct diagnosis has been missed in only 6 of 28 cases. This would seem to emphasize the correctness of Goethe's remark, "Man sieht nur was man weißt" (cit Fried). While carcinoma of the lung was regarded as a rare disease, it was rarely recognized except at autopsy.

The accompanying tables show the initial symptoms and the chief symptoms in our series of cases and their duration.

**First Symptoms**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>10 cases (21.73%)</td>
</tr>
<tr>
<td>Cough</td>
<td>11 cases (23.89%)</td>
</tr>
<tr>
<td>Loss of weight</td>
<td>1 case (2.17%)</td>
</tr>
<tr>
<td>Asthma</td>
<td>5 cases (10.87%)</td>
</tr>
<tr>
<td>Osteoarthropathy</td>
<td>3 cases (6.52%)</td>
</tr>
<tr>
<td>Cough and dyspnea</td>
<td>3 cases (6.52%)</td>
</tr>
<tr>
<td>Loss of weight and fatigue</td>
<td>3 cases (6.52%)</td>
</tr>
<tr>
<td>Swelling of abdomen due to liver</td>
<td>1 case (2.17%)</td>
</tr>
<tr>
<td>Cough, hoarseness, loss of weight</td>
<td>1 case (2.17%)</td>
</tr>
<tr>
<td>Pain of metastasis</td>
<td>1 case (2.17%)</td>
</tr>
<tr>
<td>Cough and loss of weight</td>
<td>1 case (2.17%)</td>
</tr>
<tr>
<td>Cough, dyspnea and pain in chest</td>
<td>1 case (2.17%)</td>
</tr>
<tr>
<td>Dysphagia</td>
<td>2 cases (4.34%)</td>
</tr>
<tr>
<td>Cough and pain</td>
<td>5 cases (10.87%)</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>4 cases (8.69%)</td>
</tr>
<tr>
<td>Nausea, vomiting, and headache</td>
<td>1 case (2.17%)</td>
</tr>
<tr>
<td>Headaches, weakness and pain</td>
<td>1 case (2.17%)</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>1 case (2.17%)</td>
</tr>
<tr>
<td>Malaise and fever</td>
<td>1 case (2.17%)</td>
</tr>
<tr>
<td>Cough, chill, and fever</td>
<td>1 case (2.17%)</td>
</tr>
</tbody>
</table>

In summary the duration may be stated as follows:

<table>
<thead>
<tr>
<th>Duration</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than one month</td>
<td>1 case</td>
</tr>
<tr>
<td>Less than 3 months</td>
<td>15 cases</td>
</tr>
<tr>
<td>Less than 6 months</td>
<td>13 cases</td>
</tr>
<tr>
<td>Less than 12 months</td>
<td>9 cases</td>
</tr>
<tr>
<td>Less than 15 months</td>
<td>5 cases</td>
</tr>
<tr>
<td>Over 15 months</td>
<td>3 cases</td>
</tr>
</tbody>
</table>

**Symptoms**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cough</td>
<td>42 cases (91.30%)</td>
</tr>
<tr>
<td>Pain</td>
<td>33 cases (71.73%)</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>27 cases (58.69%)</td>
</tr>
<tr>
<td>Loss of weight</td>
<td>27 cases (58.69%)</td>
</tr>
<tr>
<td>Fever</td>
<td>25 cases (54.34%)</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>14 cases (30.43%)</td>
</tr>
<tr>
<td>Osteoarthropathy</td>
<td>3 cases (6.52%)</td>
</tr>
<tr>
<td>Clubbed fingers</td>
<td>5 cases (10.87%)</td>
</tr>
<tr>
<td>Nausea and vomiting</td>
<td>3 cases (6.52%)</td>
</tr>
<tr>
<td>Headache</td>
<td>3 cases (6.52%)</td>
</tr>
<tr>
<td>Weakness</td>
<td>1 case (2.17%)</td>
</tr>
<tr>
<td>Edema of lungs</td>
<td>1 case (2.17%)</td>
</tr>
</tbody>
</table>
### PRIMARY CARCINOMA OF THE LUNG

**Duration of Symptoms Referable to the Disease**

<table>
<thead>
<tr>
<th>No. of case</th>
<th>Duration before admission</th>
<th>Total duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1 week pain</td>
<td>2 weeks</td>
</tr>
<tr>
<td>II</td>
<td>3 weeks cough</td>
<td>4 months</td>
</tr>
<tr>
<td>III</td>
<td>5 months abdominal tumor</td>
<td>5½ months</td>
</tr>
<tr>
<td>IV</td>
<td>5 months pain</td>
<td>6 months</td>
</tr>
<tr>
<td>V</td>
<td>6 months hemoptysis</td>
<td>7 months</td>
</tr>
<tr>
<td>VI</td>
<td>1 month loss of weight</td>
<td>4 months</td>
</tr>
<tr>
<td>VII</td>
<td>18 months cough since influenza; 5 months swollen nodes</td>
<td>Died day after admission</td>
</tr>
<tr>
<td>VIII</td>
<td>9 months cough and dyspnea</td>
<td>11 months</td>
</tr>
<tr>
<td>IX</td>
<td>13 weeks pain</td>
<td>5 months</td>
</tr>
<tr>
<td>X</td>
<td>3 months loss of weight</td>
<td>3 months</td>
</tr>
<tr>
<td>XI</td>
<td>1 year pain</td>
<td>13 months</td>
</tr>
<tr>
<td>XII</td>
<td>Pain off and on for 3 to 4 years; 6 months pain</td>
<td>7 months</td>
</tr>
<tr>
<td>XIII</td>
<td>6 weeks dyspnea</td>
<td>6 weeks</td>
</tr>
<tr>
<td>XIV</td>
<td>3 months cough</td>
<td>8 months</td>
</tr>
<tr>
<td>XV</td>
<td>6 months cough (always asthma)</td>
<td>7 months</td>
</tr>
<tr>
<td>XVI</td>
<td>? (asthma for 20 years)</td>
<td>Died 7 weeks after admission</td>
</tr>
<tr>
<td>XVII</td>
<td>2 months pain</td>
<td>2 months</td>
</tr>
<tr>
<td>XVIII</td>
<td>3 years cough and loss of weight</td>
<td>3 years</td>
</tr>
<tr>
<td>XIX</td>
<td>3 months cough</td>
<td>6 months</td>
</tr>
<tr>
<td>XX</td>
<td>9 months hemoptysis</td>
<td>15 months + (?)</td>
</tr>
<tr>
<td>XXI</td>
<td>1 week cough and dyspnea</td>
<td>2 months</td>
</tr>
<tr>
<td>XXII</td>
<td>2 weeks pain</td>
<td>3 months</td>
</tr>
<tr>
<td>XXIII</td>
<td>9 weeks dyspnea</td>
<td>11 weeks</td>
</tr>
<tr>
<td>XXIV</td>
<td>2 months headache, dizziness</td>
<td>14 months</td>
</tr>
<tr>
<td>XXV</td>
<td>1 year cough</td>
<td>14 months + (?)</td>
</tr>
<tr>
<td>XXVI</td>
<td>1 year hemoptysis</td>
<td>9 months</td>
</tr>
<tr>
<td>XXVII</td>
<td>2 weeks pain</td>
<td>6 months</td>
</tr>
<tr>
<td>XXVIII</td>
<td>3 months pain in hands and feet</td>
<td>2 months</td>
</tr>
<tr>
<td>XXIX</td>
<td>Cough for years; 6 weeks weakness</td>
<td>11 months</td>
</tr>
<tr>
<td>XXX</td>
<td>4 weeks pain</td>
<td>2 months</td>
</tr>
<tr>
<td>XXXI</td>
<td>3 weeks pain</td>
<td>13 months</td>
</tr>
<tr>
<td>XXXII</td>
<td>1 year loss of weight and weakness</td>
<td>5 months</td>
</tr>
<tr>
<td>XXXIII</td>
<td>3 months cough</td>
<td>3 months</td>
</tr>
<tr>
<td>XXXIV</td>
<td>2 months cough</td>
<td>8 months</td>
</tr>
<tr>
<td>XXXV</td>
<td>3 weeks cough</td>
<td>9 months + (?)</td>
</tr>
<tr>
<td>XXXVI</td>
<td>5 months pain</td>
<td>18 months</td>
</tr>
<tr>
<td>XXXVII</td>
<td>1 year pain and weakness, right arm</td>
<td>10 months</td>
</tr>
<tr>
<td>XXXVIII</td>
<td>6 months pain</td>
<td>3 months</td>
</tr>
<tr>
<td>XXXIX</td>
<td>3 months dyspnea</td>
<td>2 months</td>
</tr>
<tr>
<td>XL</td>
<td>3 weeks abdominal pain</td>
<td>14 months</td>
</tr>
<tr>
<td>XI</td>
<td>1 year dyspnea</td>
<td>2 years</td>
</tr>
<tr>
<td>XLI</td>
<td>2 years cough</td>
<td>5 months</td>
</tr>
<tr>
<td>XLI</td>
<td>3 months dyspnea, weakness</td>
<td>3 months</td>
</tr>
<tr>
<td>XLI</td>
<td>3 days cough</td>
<td>8 months</td>
</tr>
<tr>
<td>XLV</td>
<td>10 weeks pain</td>
<td>3 months</td>
</tr>
<tr>
<td>XLVI</td>
<td>3 months pain</td>
<td></td>
</tr>
</tbody>
</table>

**Differential Diagnosis**

The differential diagnosis of carcinoma of the lung is difficult and always requires exclusion of the more common pulmonary conditions. In the early stage, before the development of physical signs, it is well to remember the dictum of Moses: "When a cough persists without obvious cause, accompanied by other minor thoracic symptoms or loss of weight, one must think of carcinoma of the lung," and it is here that bronchoscopy may lead to an early
diagnosis. X-rays should also be taken at frequent intervals and may reveal the infiltration due to a beginning bronchial tumor.

Tuberculosis is perhaps the disease with which bronchial cancer is most often confused in an early stage. The cough, loss of weight, x-ray appearance of peribronchial infiltration, hemoptysis, all present a similar appearance. The less common occurrence of fever and the absence of tubercle bacilli in the sputum are helpful in making a diagnosis; but here too bronchoscopy is the main reliance. Unfortunately, in ward services such early cases are rarely seen, and our main problem is to distinguish the more advanced lesions from other pulmonary conditions. In our series, 6 cases were diagnosed and treated as abscess of the lung, the underlying carcinoma remaining undiscovered until autopsy. Such patients have the fever, foul sputum, and other signs of pulmonary abscess and the lesion is indistinguishable by x-ray or physical examination. A longer pulmonary history and the absence of an acute onset following pneumonia or throat operation may arouse suspicion of the true pathological condition. The presence of a small primary lung lesion with a much larger metastasis as in the liver may frequently lead to a false diagnosis, or a brain metastasis with cerebral symptoms may confuse the clinical picture and completely mask the pulmonary lesion. A mediastinal neoplasm, as lymphosarcoma or Hodgkin's disease, may be indistinguishable from a bronchial carcinoma with mediastinal metastasis. Here the correct diagnosis may frequently be made by bronchoscopic examination.

Involvement of the pleura will also obscure the picture, giving the clinical appearance of a pleurisy. In such cases the fluid is often bloody and sometimes tumor cells may be demonstrated. Benign neoplasms and cysts of the lung may at times cause incorrect diagnosis. Their shadows are usually more discrete, but in one of our cases post-mortem examination disclosed a perfectly discrete neoplasm.

**Treatment**

Until recently, the outlook for these patients was hopeless, but since the introduction of the bronchoscope, a number of cases have been reported in which the growth has been removed without recurrence. Lobectomy and pneumonectomy have been successfully performed for primary carcinoma as for other pulmonary conditions, but the operation is still too new for reports of five-year results. Two such operations were done in our series, in Cases XXXVI and XLIV. In the former case the patient survived operation but death ensued within six months. Case XLIV, with symptoms apparently following gassing, presumably with mustard gas; was perhaps our most favorable case. Symptoms appeared in 1922 and the patient came under observation in 1935 with a history of repeated attacks of what was apparently a left upper lobe pneumonia, the signs of which never completely cleared up. The removed lobe showed atelectasis, numerous abscesses but no carcinoma in the first frozen sections taken. Later sections, however, showed peribronchial infiltration by carcinoma, and pneumonectomy was then performed. The patient did well until fifteen hours after operation, when edema of the lung appeared. It is our belief that had a pneumonectomy been done at the start,
the patient would have had an excellent chance for radical cure. Two earlier attempts at removal of discrete tumors proved rapidly fatal.

Radiation by x-ray or radium has proved disappointing, though very few patients were treated before the terminal stages. Pain was ameliorated in at least one case of bony metastasis of a squamous-cell tumor, Case XX; the cervical nodes promptly regressed under 500 r units in Case XXI, in which an undifferentiated tumor was present; while the nodular basal-cell tumor in Case XXIX showed no change in outline after a similar dose. In Case XXXVII, with a cuboidal-cell tumor, 5400 r were given during five months, but there was little improvement in the general condition. No case has received a Coutard series comparable to that described by Jacox. His patient with a glandular, mucus-producing, superior sulcus tumor received 8,400 r, with relief of pain for two months. A cordotomy was resorted to later.

A few patients have shown temporary amelioration of pressure symptoms, and some regression of the x-ray shadow. Spinothalamic section has been performed only once, in Case XXXVIII. It was followed by complete relief of previously intractable pain. For the remainder, supportive treatment and morphine are all that can be offered.

**Prognosis**

The outlook for these patients is still extremely bad, though a few early cases may be cured by bronchoscopic removal of the tumor. Certainly, our advice should be less conservative, and operation, both for diagnosis and radical extirpation, should be much more frequently considered.

With the advance in thoracic surgery, we may hope for better results from radical surgery. The clinician's part should be to make as early a diagnosis as possible of this condition, so hopeless if diagnosis is deferred.

**Case Reports**

**Case I (Med. No. 106):** A. B., a married woman of forty years, was admitted Dec. 13, 1904, five months after a severe attack of pain of sciatic distribution. A month before admission she had suffered from cough, chills, and presumably fever; a week before she experienced severe cutting pain in the chest, and this was the chief complaint on admission. It was made worse by breathing and was evidently of pleuritic origin.

The patient was well nourished and slightly cyanotic. The chest findings were as follows: heart 1/4 in. to the right, apex 6 in. to the left in the fourth interspace; dulness extending from the apex to the axilla on the left; breath sounds harsh at the apex, diminished below the third rib; bronchial voice in the axilla; right lung clear; posteriorly, dulness over the left base, flatness at the angle of the scapula, diminished breathing at the bases. There was no tenderness over the sciatic nerve.

The course was febrile, with a temperature of 100° to 103° and slight leukocytosis. Death occurred ten days after admission.

The clinical diagnosis was pleurisy with effusion.  

*Autopsy* (No. 512): The tumor occupied a portion of the left upper lobe, where one of the large bronchi was occluded by a soft pale growth; above this was a firm nodule 3 cm. in diameter and nearby was a similar nodule. The bronchi of the left lung were filled with purulent material. In the left pleural cavity were 60 c.c. of fluid.

There was thrombosis of the right pulmonary artery and on the pericardial sac was a mass 5 × 3 cm. The right lung was relatively normal. The right adrenal was involved by tumor.

1 Thanks are due Dr. Warren Gilbert for assistance in the preparation of the clinical histories.
Microscopically the tumor was composed of large cuboidal or columnar cells growing in small acini separated by a small amount of connective tissue, producing the picture known as adenocarcinoma. In the bronchial nodes, which also contained tumor, giant multinucleated cells occurred.

Comment: This case, the earliest in our series, illustrates a bronchial carcinoma masked by a pleurisy with effusion; the original diagnosis was pleurisy with probable underlying pneumonia.

Case II (No. 4900): E. L., a sixty-one-year-old salesman, was admitted July 29, 1921, with history of cough, loss of weight and strength, and a moderate degree of hoarseness which had developed gradually over two months. He had been confined to bed for two weeks before admission. Cough had gradually increased, with a thick mucopurulent expectoration, a septic temperature, and much loss of weight. Sputum examination was negative for tubercle bacilli.

On admission the patient was dyspneic and spoke with difficulty on account of hoarseness. The left lung showed absence of vesicular resonance and a flat percussion note. On the right were dulness at the base and signs thought to be due to consolidation. The liver was palpated 5 cm. below the costal margin.

X-ray examination showed fibrosis in the left lung, with areas of lessened density, especially in the lower part. The heart appeared to be slightly enlarged. The diagnosis was extensive bronchiectasis; possibly multiple abscesses; no evidence of new growth or pulmonary tuberculosis.

Laryngological examination revealed considerable infiltration of the right half of the larynx, involving the vocal cords, which showed impaired movement. There was an ulcer on the left cord which in the opinion of the laryngologist might have been tuberculous, syphilitic, or malignant.

The course was febrile; the sputum profuse, bloody, and purulent. Death occurred two days after admission. Clinically, the patient was believed to be suffering from multiple bronchiectasis, with some abscess formation.

Autopsy (No. 1535): The tumor was found arising from the left main bronchus at its bifurcation, near the origin of the branch to the left upper lobe. The mucous membrane was also invaded in the main branch to the lower lobe. The tumor in the lung was relatively small, but there were large masses of bronchial, peribronchial, tracheal, and cervical nodes, firmly adherent to the pericardium and the great vessels. There was purulent material in nearly all the bronchi, but no fluid in either side of the chest.

The right lower lobe contained many purulent cavities, some of which were crossed by thrombosed vessels, this bronchiectasis being due apparently to the blocking of the bronchi by the pressure of the large mass of nodes at the hilus.

There were metastases in the liver and the bronchial and cervical nodes.

Microscopically this tumor was of the undifferentiated so-called oat-cell type, the nuclei appearing oval or spherical in cross-section, but slightly elongated and pointed at the ends when seen in their longitudinal diameter. There was practically no differentiation, and there was no attempt at gland formation.

Comment: This case is interesting because the long-standing cough was attributed, on both clinical and x-ray evidence, to bronchiectasis, and the fatal issue to an infection leading to abscess of the lung. The underlying neoplastic condition was not suspected before death.

Case III (No. 5359): C. S., a housekeeper of sixty-two years, was admitted Jan. 9, 1923. Five months before admission she began to notice swelling in the pit of the stomach. She was without other symptoms until four to six weeks before admission, when she experienced palpitation on slight exertion and dyspnea. She also complained of loss of appetite, attacks of nausea with vomiting and dull intermittent epigastric pain, loss of weight, and slight unproductive cough for three weeks before admission.

The past history was irrelevant except for pneumonia five years earlier, followed by
an empyema which had drained for sixteen months and finally healed two years before admission.

The patient was a feeble, intelligent woman with a dry, hacking cough. In the right temporal region was a hard, slightly tender swelling surrounded by prominent veins. Chest expansion was diminished on the left side. The upper border of the heart was 15 cm. to the left. The entire left chest anteriorly and posteriorly was dull, with broncho-vascular breathing and increased voice sounds, but no râles. The abdomen was distended. A large irregular mass, evidently the liver, extended from the ensiform cartilage to the umbilicus, with an irregular notched lower edge.

X-ray examination showed retraction of the heart to the left and of the trachea and mediastinum; also increased density of the left chest as high as the apex. The picture was interpreted as an old empyema with fibrotic contraction.

Gastro-intestinal films showed twenty-four hour retention, some narrowing in the region of the pylorus, and six-hour retention. There was evidence of pressure on the entire lesser curvature from the mass in the epigastrium.

The clinical diagnosis was carcinoma of the liver probably secondary to carcinoma of the stomach. The pulmonary condition was believed to be due to the old empyema. In the hospital the patient gradually declined and died ten days after admission. The course was entirely afebrile.

Autopsy (No. 1721): The tumor appeared to originate in the first left upper branch of the main bronchus to the lower lobe, with tubular peribronchial extensions throughout. The remainder of the lobe showed, also, productive pneumonia, bronchiectasis, and purulent bronchitis. The left pleural cavity was almost entirely obliterated by adhesions, with an especially dense mass adherent to an old thoracotomy incision in the left lower portion of the chest wall, and to the bodies of the lower thoracic vertebrae.

The right chest contained 400 c.c. of fluid; the pleura was smooth, the lung very edematous.

There were metastases to the pleura of the left upper lobe, the kidneys, the liver, and the right adrenal.

Microscopically the tumor was of the tall columnar adenocarcinoma type with papillary formation in partially formed glandular acini. The tumor cells showed a tendency to grow along the alveolar walls, replacing the normal lining.

Comment: This is an excellent instance of primary carcinoma of the lung masked by an old empyema, the clinical attention being directed solely towards a metastatic abdominal lesion. The x-ray findings and the gastric analysis seemed to confirm the clinical diagnosis of primary carcinoma of the stomach with metastasis to the liver. The pulmonary condition gave practically no symptoms. Those which were observed were attributed to the old empyema, as was the retraction of the heart and mediastinum, instead of to an atelectatic collapse of the lung. The x-ray appearance of the pylorus was due to a benign papilloma.

CASE IV (No. 62018): E. F., a porter thirty-nine years old, was admitted Oct. 3, 1923, with pain in the chest of five months' duration, accompanied by pain and stiffness of the muscles of the neck, back, and arms. He had first noticed the pain in the left upper arm and anterior chest, going through the left shoulder. It had gradually grown worse and was exaggerated on deep inspiration and cough. There was some cough with expectoration of mucus. In the past four years the weight had dropped from 187 to 136 lbs. without loss of appetite or strength. There were night sweats and fever. The past history was irrelevant.

The patient was emaciated and chronically ill. The chest findings were as follows: over the right lung, breath sounds prolonged and exaggerated at the apex, with a few râles after cough; many râles over left chest after cough; prolonged expiration over the lower part of the left lung; heart negative except for a systolic murmur at the apex. The right abdominal reflex was absent. The left knee-jerk was greater than the right. There were fibrillary twitchings in the muscles of the shoulder girdle. The blood pressure was 115/70.
There was no pigmentation of the skin or mucous membranes, and no osteoarthropathy. No mention was made of the fingers.

An x-ray film of the chest showed increased density at the left apex with apparent increase in the mediastinal shadow. The right hilus shadow was increased and there was an increase in the shadows about the root and bronchi, indicating bronchial pneumonia. Small areas of increased density were seen about the hilus of each lung. In the region of the 8th rib on the right side was a rarefied area.

The patient was drowsy on admission. A lumbar puncture the following day yielded 45 c.c. of clear fluid, showing increased pressure, three cells, globulin plus. Examination of the fundi showed the discs congested. The patient became incontinent. Several more lumbar punctures were done under increased pressure but all showed a low cell count. A red swollen area appeared on the left thumb, but incision yielded no pus. Section showed carcinoma of the mucoid type. A small nodule, also carcinoma, was removed from the right flank. While in the hospital the patient developed several subcutaneous nodules. He died Oct. 25, 1923.

Autopsy (No. 1860): The tumor originated in the left upper lobe, probably in the main bronchus to this lobe, with extensions outward to the apex, where there was a mass 3 cm. in diameter. Tumor nodules were also found on the pleura of this lobe.

The right lung showed an old tuberculous scar at the apex, but no tumor.

There were metastases to the sternum and the first rib, one of the metacarpal bones, the bronchial and mediastinal nodes, the skin, liver, and both adrenals.

Microscopically the tumor was of the glandular and alveolar type, with a tendency to the formation of small alveoli closely resembling mucous glands around the bronchi. Many of the cells secreted considerable mucus. There were giant cells in the primary tumor.

Comment: An interesting case with long standing chest pain before the onset of cough. The symptoms due to cerebral metastasis directed clinical attention to the brain.

Case V (No. 6168): M. R., a sixty-three-year-old woman, was admitted Nov. 29, 1923, with a year's history of swelling of the limbs and clubbed fingers. For the past six months she had had repeated but slight hemoptyses and for over a year had been losing weight. For two weeks prior to admission she had had pain in the precordial region and along the left costal margin, with dyspnea.

Physical examination showed a small, fixed, tender subcutaneous nodule in the right parietal region and another node at the angle of the jaw. Over the left lung resonance was impaired anteriorly except at the apex and subclavicular portion; posteriorly there was an area of flatness from the angle of the scapula down the right lung. Breath sounds were diminished over the left lung except in the second and third interspaces, where there were bronchial breathing and pleural friction rub. Flatness here merged into heart dulness. Many coarse râles were heard posteriorly. The liver was palpated below the costal margin, and was irregular in outline. Very decided clubbing of the fingers was observed. The course was afebrile except terminally, when the temperature rose to 100.4°.

An x-ray film showed a circular shadow of increased density in the left chest, measuring 7 cm. in transverse diameter and extending up to the level of the second anterior rib. There was no displacement of the heart, but a shadow was present from the tumor mass to the base. Aspiration of the left chest yielded 20 oz. of fluid prior to roentgen examination.

The clinical impression was cardiac decompensation and neoplasm of the left lung. There was no evidence of carcinoma elsewhere except for a probable metastasis in the liver.

Autopsy (No. 1884). Autopsy was limited to the removal of an enlarged right cervical node, which showed carcinoma with a considerable tendency toward the formation of sheets of cells showing squamous characteristics with some pearl formation.

Comment: While the presence of osteoarthropathy in this case indicates a long-standing pulmonary lesion, the symptoms prior to hospital admission, were rather those of cardiac decompensation except for the loss of weight.
Case VI (No. 6758): M. H., a fifty-three-year-old housewife, was admitted March 3, 1923, with a history of headache for ten days, leading to syncope and accompanied by nausea and vomiting. She had had no chills or fever.

Physical examination of the lungs was negative. There was a sense of mass in the epigastrium. The clinical impression was carcinoma of the stomach.

X-ray examination showed diverticulitis of the duodenum. Fluoroscopy of the chest revealed density continuous with the mediastinum, suggesting lung tumor. This was later considered to be a fibrotic change. The skull appeared thin in the parietal region. The pelvis of the right kidney did not show in the pyelogram. Later paralysis of the left arm and leg developed and was attributed to cerebral metastasis. The patient died June 5, 1923.

Autopsy (No. 1798): The tumor, primary in the left upper lobe, formed a hard grayish mass extending throughout the upper portion of the lobe nearer the apex than the hilus. No bronchial origin was found.

The right chest contained no fluid; the pleura was smooth, and the lung well aerated. There were two metastases to the skull, one to the occipital and one to the right parietal bone, and also one to the right adrenal.

Microscopically the tumor was in most parts undifferentiated, but in a few areas the cells were columnar, lining the alveolar air spaces, which were largely filled with necrotic tumor. There were many giant forms.

Comment: A case in which the abdominal and adrenal condition, with paralysis due to cerebral metastasis, directed clinical attention away from the primary lesion.

Case VII (No. 6418): E. R., a thirty-six-year-old woman, was admitted on March 16, 1924. She had not felt well for one and a half years and had been losing weight. Prior to that time she had a chronic cough and was susceptible to colds. Five months before admission she began to feel worse, noticed swelling of the nodes on the left side of the neck, and experienced dyspnea on exertion. The enlarged nodes had been removed in another hospital, but the patient did not know the pathological details. The nodes had grown steadily since, and there had been increasing weakness and orthopnea, with frequent night sweats, some cough, and pain in the left chest. The left breast and arm began to swell one month before admission.

Physical examination revealed hard nodes on both sides of neck which were greatly enlarged, standing out as firm nodular masses almost meeting in the midline. The left breast was swollen and edematous. The chest showed dulness at the left apex and right base. The heart was pushed to the right and the mediastinum was greatly widened. Posteriorly there was dulness in the paravertebral region and at the extreme right base. The left base showed diminished resonance with decreased fremitus. Posteriorly, the breath sounds were bronchial, almost amphoric, at the left apex, while a few râles were audible at the left base. The breath and voice sounds were diminished.

The clinical diagnosis was mediastinal neoplasm with compression of the lung at the left apex. The probability of carcinoma of the lung with metastases in the mediastinal lymph nodes was considered.

The patient had a moderate secondary anemia, with a leukocyte count of 25,200. On admission the temperature was 102° and death occurred within twenty-four hours.

Autopsy (No. 1945): The tumor was found replacing almost the entire left upper lobe, which was densely adherent partially by fibrous adhesions and also by masses of tumor which covered the opposing pleural surfaces. No single bronchus could be considered the site of origin, although the apex of the upper lobe had apparently been involved for the longest time. The bronchi of the left lower lobe contained much purulent material.

The right chest contained 600 c.c. of blood-tinged fluid. The pleura was free except at one point in the upper medial side. The tumor had involved and caused stenosis of the right main bronchus and compressed the vessels at the right root. The lung was extremely crepitant and edematous. There were 400 c.c. of cloudy fluid in the pericardial sac.

In the trachea was a secondary nodule, and the superior vena cava and left ventricular
wall were invaded. There were metastases in the cervical and abdominal nodes, the uterus, and right ovary.

Microscopically the tumor was of the small undifferentiated type, many of the cells being oval and the rest slightly spindle-shaped. There were giant cells in the primary tumor.

Comment: The interest in this case lies in the duration of the tumor. The patient was almost moribund on admission, and died within twenty-four hours, so that an extended investigation could not be made. As in all bronchial carcinomata with a long history of cough, the question arises as to how long the symptoms were cancerous and how long precancerous.

Case VIII (No. 7565): F. D., a sixty-six-year-old German jeweler, was admitted Feb. 14, 1924, complaining of cough and dyspnea of nine months' duration, impaired appetite, and loss of some 50 pounds in weight in the same period. For the past five days he had suffered from pain in the right posterior chest, worse on breathing. The cough had throughout been productive of white frothy mucus, which occasionally contained streaks of blood. The past history was irrelevant.

The right lower chest was flat with absence of fremitus, breath sounds, and voice sounds. Above, moist rales were audible. There was bronchovesicular breathing at the angle of the right scapula. Moderate anemia was present. The sputum was negative for tubercle bacilli. The prostate was enlarged and soft.

X-ray plates of the right chest showed a very opaque shadow at its base, suddenly becoming more luminous as the apex was approached. The source of the shadow was evidently pleural, with secondary pulmonary infiltration. The cardiac shadow was not visible on the right, but was believed to be grossly displaced. On Feb. 15, 150 c.c. of clear fluid were obtained from the right chest. In a roentgenogram taken on March 5 a dense process was still visible at the right base, but below the line of the pleura the lung showed evidence of compression.

The condition in the left chest (coarse and squeaking rales) cleared up, and the patient was discharged March 27, feeling better. The fluid was believed to be secondary to a neoplasm.

Within three weeks the patient was readmitted, April 15, having done well until one week before, when he caught cold. He had some fever and a leukocytosis. Death occurred on the fifth day in the hospital.

Autopsy (No. 1961): The tumor was found at autopsy invading the right lower lobe, which was adherent by old fibrous adhesions. The right upper lobe contained tuberculous scars with calcification at the apex. The mass almost completely filled the main bronchus to the lower lobe, which was converted into a tumor measuring $12 \times 9 \times 12$ cm. The vessels were compressed and the center of the mass had undergone necrosis with suppurating cavities outside the tumor.

The left lung was free, the upper lobe aerated; the lower showed bronchopneumonia.

The growth had metastasized to the liver, the first rib on the left, which showed a pathological fracture, the mediastinal nodes, the kidney, prostate, and left adrenal.

Microscopically the growth was a small undifferentiated type with spindle or oval cells and no tendency to gland formation.

Case IX (No. 6611): S. W., a fifty-two-year-old woman, was admitted May 27, 1924, with pain in the right leg and knee and slight pain in the right chest. Thirteen weeks prior to admission she had had a bad cold, with pain in the right side and difficulty in breathing. This improved in two weeks but was immediately followed by the pain in the leg. Health had been good up to the present illness, and the past history was unimportant.

The patient appeared chronically ill, with occasional tremor of the extremities, moist skin, pupils irregular but reacting to light and accommodation. The lungs were dull at both apices, with exaggerated breath sounds especially on the right, and occasional rales at the bases. The right tibia from just below the knee to the ankle was reddened, hot, and acutely tender. In the upper section, medially, enlargement was more marked, and non-fluctuating. The knee-joint was not involved. Diagnosis: periostitis of the right tibia.
PRIMARY CARCINOMA OF THE LUNG

X-ray showed the periosteum thickened but without irregularity. The blood count was: 71 per cent hemoglobin, 4,800,000 red cells, 7,200 white cells, with 60 per cent polymorphonuclears.

The patient was transferred to the surgical division for a biopsy of the tibial enlargement, which showed carcinoma. A month later she was semi-stuporous, delirious, and incontinent, with pulmonary signs attributed to bronchial pneumonia. Death occurred July 23.

Autopsy (No. 2004): The right lower lobe was adherent throughout, with dense adhesions, but the upper lobe was free. The tumor appeared to have arisen at the apex of the right lower lobe and extended outward from the hilus. No one bronchus could be regarded as the source of the growth.

The left lung was edematous but showed no tumor.

Metastases were present in the liver, ribs, both adrenals, kidneys, ovaries, and bronchial nodes.

Microscopically the growth consisted of cuboidal or columnar papillary and adenomatous structures, some of the cells producing a large amount of mucus.

Comment: What was apparently an inflammatory lesion of the leg so overshadowed the lung signs that the case was treated as a surgical one. The patient rapidly became moribund.

Case X (No. 41692): A. H., a forty-seven-year-old man, was admitted Oct. 17, 1924, complaining of progressive weakness, headache, and pain in the chest, shoulder, and arm for two months, made worse by his work as a carpenter. A month before that he lost appetite, was readily fatigued, and began to lose weight. He had consulted a local practitioner, rested for five days, returned to work, and again had to stop. For one and a half months he had had constant cough, at first raising whitish material, then a yellow tenacious mucus, but no blood. He seldom had fever and then only for a day at a time. The earlier history was unimportant.

The patient was undernourished and appeared chronically ill. A few nodes were palpable in the submaxillary region. The chest findings on the right side were as follows: expansion limited; upper half anteriorly flattened to percussion; posteriorly flatness from apex to spine of scapula; diminished breath sounds over this area, of bronchial character but not of true bronchial type; whispered voice increased but not the spoken voice; no râles. The left lung was normal.

A roentgenogram, Oct. 23, showed a shadow on the right side at the apex. There was, however, greater density above the diaphragm, which might indicate the existence of an associated pleuritis or a direct extension of the original process higher up.

The clinical diagnosis was neoplasm or encapsulated fluid. Exploration of the third right interspace under the anterior axillary fold yielded about 1 c.c. of very thick grayish-yellow pus, showing on culture type I pneumococcus. The patient was transferred to the surgical division and operated on. The postoperative diagnosis was empyema. Death occurred Oct. 29.

Autopsy (No. 2054): The right lung was adherent throughout by old adhesions. A large tumor occupied the right upper lobe, replacing the lung tissue.

The left lung was well expanded; the pleura was smooth.

Metastases were limited to the regional nodes on the right side.

Microscopically the tumor was a carcinoma, fairly well differentiated, and showing squamous areas.

Comment: A case where a finding of pus obscured the correct diagnosis originally made.

Case XI (No. 42036): T. V., a sixty-five-year-old American druggist, was admitted Oct. 20, 1924, complaining of cough, dyspnea, and pain in the chest and back for the past year. The cough was at first non-productive, but for nine months had been productive of large amounts of yellow sputum, sometimes blood-streaked. Two months before admission the patient had had a severe hemorrhage lasting almost all night, and streaking had
persisted for a week. Ten days later another hemorrhage occurred, followed by several more attacks of hemoptysis during the summer. The patient went to a sanitarium, but was told that he did not have pulmonary tuberculosis, and was referred to the hospital for treatment.

There was a history of bilateral pneumonia in 1903 with empyema, but no pulmonary trouble since.

The chest findings were as follows: right lung anteriorly flat to the second rib and below this to the base dulness with bronchial breathing; fremitus increased on the right. The veins of the chest were dilated, more so on the right than the left. The impression was tumor of the right lung.

Bronchoscopy showed the mucous membranes of the bronchus to be hyperplastic. The right bronchus was constricted. Tissue removed showed no tumor. Death occurred Nov. 14, 1924.

Autopsy (No. 2058): The right lung was bound down by extensive adhesions, especially over the region of the first rib. The pericardial sac and the pulmonary veins were infiltrated at the bifurcation of the right main bronchus, and extending into its first branch to the upper lobe was an extensive soft cellular tumor which had invaded the mucosa of the bronchial wall and was continuous with the mass in the upper lobe. The superior vena cava was so constricted as scarcely to admit a probe.

The left lung was free except at the apex, where there was an old tuberculous scar, but the chest contained no fluid, and the remainder of the lobe was aerated. The lower lobe showed edema.

There were metastases in the bronchial nodes.

Microscopically the tumor was fairly well differentiated, showing many pearls and many squamous areas.

Comment: A case where the bronchus showed only pressure but no lesion of the mucous membrane.

Case XII (No. 45947): A. R., a thirty-three-year-old proof-reader, was admitted to the hospital May 19, 1925, complaining of difficulty in swallowing. In November of 1924 she had experienced pain in the arm and had coughed up blood, first in the morning, then later in the day. In December she experienced difficulty in swallowing, and by Christmas she could take no solid food. Examination at Saranac gave no definite evidence of tuberculous infiltration. There had been a loss of weight of 30 pounds prior to admission.

The percussion note was normal on the right. Breath and voice sounds were accentuated down to the sixth thoracic spine. Above the median line in the axilla was an area of fine riles. The left chest was hyperresonant anteriorly; posteriorly there was dulness to the fourth spine. Anteriorly distant cavernous breathing was present over the upper lobe and absent over the lower. The heart borders were not ascertainable. The liver edge was just palpable. The clinical impression was esophageal obstruction and left pneumothorax. While a primary lesion of the lung was considered, an esophageal lesion was regarded as more probable.

A roentgenogram, May 20, showed a shadow at the left base, interpreted as an old pleuritic lesion.

There was moderate anemia: hemoglobin 71 per cent; 3,500,000 red cells; 16,800 white cells. The course was afebrile. On May 28 esophagoscopy was done, obstruction at the cardia being overcome by gentle pressure with a swab. The diagnosis was cardio-spasm. Gastrostomy was done June 15. The patient was given clyses for several days and appeared better. Subsequently olivary bougies were passed up to No. 34.

A chest film, July 14, showed a small amount of fluid in the left chest with thickening of the pleura at the apex. The heart was displaced to this side. Just lateral to the left border of the heart was an area of increased density which was regarded as possibly due to encapsulated fluid. There was no evidence of tumor growth to the right of the vertebral column. The gastrostomy tube could be seen in position. The patient died July 28.

Autopsy (No. 2167): There were 500 c.c. of fluid in the left chest. The diaphragm was rigid and fixed and was invaded on its abdominal side by the growth, which occupied
the left lower lobe, arising from one of the large bronchi to this lobe and radiating outward along the course of the other bronchi.

The peribronchial nodes were invaded, and there were metastases to the diaphragm and the right adrenal.

The right chest contained no fluid; the pleura was smooth; the upper lobe was aerated, but the lower lobe showed much productive inflammation and purulent bronchitis.

Microscopically the tumor was of the small-cell, undifferentiated spindle or oat-cell type, with little stroma and considerable necrosis.

Comment: A case of bronchial carcinoma with symptoms of pressure on the esophagus which masked the presence of the pulmonary lesion. It was originally considered metastatic.

CASE XIII (No. 50878): C. C., a sixty-three-year-old man, was admitted to the ward March 16, 1926, with extreme dyspnea. On Feb. 2, while climbing a hill, he had become very dyspneic and was told by a local physician that he had bronchitis. He had no fever and very little cough. On Feb. 14 he was told that he had pneumonia and after that pleurisy. Aspiration had been done and 36 oz. of bloody fluid removed. Four days later 45 oz. were removed, and four days after that 45 oz. Up to this time, however, he complained only of dyspnea and declared that the room seemed stuffy to him. Three days before admission a hacking cough developed with bloody sputum. The earlier history was unimportant except for an attack of influenza six years prior to admission, one year after the great epidemic.

The right chest expanded less than the left, and showed flatness throughout, anteriorly and posteriorly, but no râles. Fremitus was absent. Breath sounds were bronchial anteriorly and absent posteriorly. The left lung was clear. The left border of the heart was displaced a little to the left. The impression was pleurisy with effusion with a question as to neoplasm of lung. X-ray examination was not made on account of patient's condition.

The right chest was tapped and 12 oz. of bloody fluid was obtained. Death occurred two days after admission.

Autopsy (No. 2270): The main bronchus of the right upper lobe was the site of the primary growth. The trachea was infiltrated 3 cm. above its bifurcation, as was the right main bronchus, and there were tubular extensions along the bronchi of this lobe. In the mediastinum was a large mass of nodes measuring about $8 \times 9 \times 6$ cm., extending to the right side, covering the aortic arch.

The left lung was free, aerated, and showed no tumor.

There were metastases to the retroperitoneal nodes, liver, and spleen.

Microscopically the cells were very small and undifferentiated, with oval and spindle-shaped forms.

Comment: Case remarkable for sudden onset of symptoms, probably due entirely to pressure of fluid in the pleural cavity. In spite of the absence of symptoms, the patient must have had a long-standing pathological condition in the bronchus.

CASE XIV (No. 48117): H. H., a fifty-two-year-old Finnish tailor, was admitted to the hospital Sept. 30, 1925, with a history of diarrhea of twenty months' duration, controlled by medication but recurrent. He had eight or ten movements a day with mucus and blood, and had lost about 40 pounds in weight. For a somewhat longer period he had suffered from asthma. He had no hemoptysis or other pulmonary symptoms.

The thorax was symmetrical, emphysematous in type, with diminished resonance over the apices and most of the right chest posteriorly. The breath sounds in these areas were harsh and bronchovesicular. A few squeaks and sibilant râles were audible in both lungs.

Proctoscopic examination showed a few discrete hemorrhages and granular mucous membrane. There was a moderate anemia: hemoglobin 74 per cent, red cells 4,700,000. Urinalysis was negative. There were no tubercle bacilli in the sputum. The stool showed blood and, on culture, B. coli communis and B. alkaligenes.
The course in the hospital was afebrile. Diarrhea was controlled and the patient was discharged Oct. 12, with a diagnosis of ulcerative colitis. The pulmonary symptoms were considered asthmatic.

On second admission, four months later, the patient reported that the diarrhea had been better for five weeks, then recurred with tenesmus. Cough had continued. Examination now showed impaired resonance over the entire left chest, flatness at the left apex, cavernous breath and voice sounds in the left supraclavicular region. Breath sounds and voice sounds were absent at the left base. Moist subcrepitant râles were audible in the left interscapular region. The right lung was negative. The patient had fever, leukocytosis, and cough with purulent expectoration.

Roentgenograms of the chest showed complete opacity on the left side. Gastrointestinal films were negative, but the colon showed definite areas of spasm especially on the right side.

Bronchoscopy was done on Feb. 26, 1926, and showed the left bronchus smaller than normal with pus exuding. About the bronchial opening on the left was granulation tissue which was bleeding freely; 2.5 cm. within the bronchus was an obstruction from which a section was removed. Microscopic examination showed carcinoma. Death occurred July 2, 1926. During the last month of life the course was afebrile.

Autopsy (No. 2306): The left lung was adherent throughout and the pleura much thickened. There was purulent exudate in the left main bronchus and both lobes contained numerous abscess cavities. In the left main bronchus, 2 cm. from the tracheal bifurcation, was a slight stenosis, surrounding which was a large ulcerated tumor which constricted the bronchus and main pulmonary artery.

The right lung was free but very heavy, congested, and edematous with purulent bronchitis.

The tumor had metastasized to the adjacent nodes.

Microscopically the tumor was definitely of the sclerosing squamous-cell type, with some groups of pavement cells, although no true pearls were present. The pathological diagnosis was carcinoma of the left bronchus with stenosis; multiple abscesses of the left lung; brown atrophy of the heart; pulmonary edema and congestion of right lung; metastasis to bronchial nodes. No carcinoma was found in the intestine.

Comment: This case is illustrative of the ease with which secondary symptoms may obscure the main disease, which was readily proved by bronchoscopy on second admission. The lung had gone on to collapse due to bronchial occlusion, making lung signs very obvious.

Case XV (No. 59846): R. P., a forty-five-year-old English bricklayer, was admitted June 7, 1927. He had always been asthmatic, but had not suffered in his general health until six months before admission, when he developed a "cold on his chest." He had no fever at the time but the cough had persisted, dry, hacking, and non-productive, without hemoptysis. Shortly after this pain in the groin appeared, shooting in character and increased by exercise. Three months before admission pain in the left shoulder blade developed, following along the rib to the precordium. This dull pain had persisted and was constant, being sometimes worse under the scapula, at other times over the precordium. It was neither relieved nor aggravated by respiration and exercise. The patient had become dyspneic since the onset of pain, and there was an area of tenderness over the lower dorsal spine. He had lost about 20 pounds in weight in three months. Except for asthma the past history was of no importance.

The patient was poorly nourished. Respiratory movements were limited on both sides, and the left lung was dull posteriorly. Throughout both lungs moist musical râles were audible. A friction rub was occasionally heard in the left axilla and over the left lung posteriorly. The clinical impression was carcinoma of the pleura. The sputum was negative for tuberculosis, moulds, yeast, and streptothrix.

An x-ray film of the chest showed a mass in the sternal area measuring 8 cm. across, mostly on the left side, partly hidden behind the descending aorta, irregular in outline, although demarcation was fairly clear. At the lower end it merged with another smaller
and more circular mass. A lateral view showed the mass in the mid-chest. In the spine, especially the dorso-lumbar area, were changes resembling infectious spondylitis.

The course in the hospital was afebrile throughout. Deep x-ray therapy was given. On June 18 the patient was unable to move the left leg, and the entire limb became anesthetic. The deep reflexes were greater on the left than the right; the Babinski was suggestive on both sides. There was difficulty in voiding. The condition was believed to be due to a compression myelitis secondary to the pulmonary lesion. Death occurred July 3, 1927.

Autopsy (No. 2445): There was no fluid in either pleural cavity. A mass of enlarged nodes was attached to the sternum, eroding it. The intercostal muscle in the second interspace was also invaded. The left main bronchus 4 cm. from the trachea was nearly surrounded by a small tumor which narrowed its lumen. The left pulmonary artery was also so constricted as scarcely to admit a probe. There were many areas of consolidation and some of necrosis.

The right lung was adherent at the apex and showed many small caseous areas, tubercles, and some cavitation.

There were extensive metastases in the ribs, mediastinal nodes, liver, kidney, pancreas, adrenals, and a nodule in the outer muscle bundles of the left ventricle.

Microscopically this tumor was of the undifferentiated small oat-cell type.

Comment: This case is instructive because, while symptoms of a neoplasm were not masked, the condition actually leading to hospital admission was a bone lesion beginning to compress the spinal cord. Somewhere in the course of the asthma, which dated back for years, the bronchial epithelium had become altered and precancerous, and finally an out and out bronchial carcinoma had developed. It is impossible to determine the actual date of onset.

CASE XVI (No. 62190): E.F., a fifty-seven-year-old chauffeur, was admitted Sept. 16, 1927, with a history of asthma for twenty years, with attacks of wheezing and inability to breathe. It had grown worse in the past two months and the patient had complained of pain in both shoulders and over the precordium. Adrenalin, prescribed at another clinic, relieved the dyspnea. Both pain and dyspnea continued to increase, but there was no hemoptysis, fever, or night sweating. The patient had lost 20 pounds in the past few months. The past history was irrelevant except for attacks of pneumonia in 1903 and 1926.

Physical examination showed a chronically ill man, with hard, irregular nodules in the skin, the size of a pea. One was at the base of the neck on the left, three were on the abdomen, and one on the back. The lungs gave a hyperresonant percussion note, many squeaks, and sonorous and sibilant râles throughout. No other physical signs were observed. The impression was probable malignant disease of the stomach with bronchial asthma.

Laboratory findings were unimportant. Gastric analysis showed free hydrochloric acid 33, total 43. The course in the hospital was afebrile until one week before death, when fever developed, of the spiked type, 101–104°. Adrenalin always gave relief.

A small nodule removed from the abdominal superficial fascia, Sept. 26, showed deeply staining cells of columnar epithelium with very large irregular nuclei and mitotic figures. The diagnosis was highly malignant carcinoma. The patient went rapidly downhill and died some six weeks after admission, Nov. 8, 1927.

Autopsy (No. 2503): The right lung was bound down on all sides by firm adhesions, and at the bifurcation of the main bronchus was a tumor 2 cm. in diameter which caused obstruction to the bronchus and infiltrated the arteries at the root of the lung. No other tumors were observed, but the hilus nodes were very large, forming a mass 10 × 8 × 5 cm.

The left lung was relatively normal. There was no fluid in the chest.

Metastases were widespread, involving the pericardial sac, the peritoneum, the perirenal fat, the inguinal nodes, liver, kidney, spleen, skin of the face and left arm, pancreas, stomach, and bladder.

Microscopically the tumor was a very small undifferentiated oval and spindle-cell type.
Comment: An excellent example of the impossibility of dating the onset of malignant growth in a history running back twenty years or more. Like other cases, this suggests that bronchial carcinoma is a disease of long duration, before relief is sought, usually for asthma, the true nature of the lesion not being suspected.

CASE XVII (No. 64561): J. P., a sixty-nine-year-old railroad investigator, was admitted to the ward March 23, 1928, with a history of dull aching pain in the left hypochondrium radiating to the left shoulder, of two months' duration. More recently there had been pain, also, in the right hypochondrium and the lumbar region. Since onset there had been cough with some white expectoration but no hemoptysis; also slight dyspnea without relation to exertion. The earlier history was unimportant.

Physical examination showed an emaciated man with large nodes in the right axilla and one in the left. The spine was rigid and painful on motion. The chest findings were as follows: almost no expansion at right apex, dulness to flatness above third rib, breath and voice sounds somewhat amphoric, distant systolic murmur over most of precordium, extrasystoles. The prostate was slightly enlarged. The clinical impression was carcinoma of the lung.

X-ray showed evidence of a mediastinal tumor involving the upper right lung field with displacement of the trachea to that side; evidently collapse of right upper lobe. A blood count showed moderate anemia.

During his two days' stay in the hospital the patient's temperature was 100–101°. He coughed up a moderate amount of bright blood and the next day vomited blood several times, and was given a transfusion. Death occurred March 26.

Autopsy (No. 2556): There was no fluid in either pleural cavity. The tumor involved the apex of the right upper lobe, extending from the hilus to the pleura; the wall of the primary bronchus could not be recognized. The lower lobe was congested but showed no tumor.

The right peribronchial and axillary nodes were apparently involved by the growth. The left lung showed no tumor.

Microscopically the tumor consisted of small undifferentiated epithelial cells growing in no organized manner, and with scarcely any stroma. The cells were small and oval or spindle-shaped.

Comment: An instance of a silent bronchial tumor with symptoms dating back only two months in spite of fact that on admission the patient was moribund. The chief complaint was pain, not over the site of the lesion.

CASE XVIII (Dr. Lambert): A. S., a fifty-five-year-old man, was admitted Sept. 3, 1929. For three years he had had cough with slight expectoration. The sputum was odorless and colorless, and there had been no hemoptysis. There was definite dulness over the right upper lobe. Scattered râles were audible over the upper lobe. Breath sounds were distant, and bronchovesicular in character. The clinical impression was lung abscess.

X-ray showed a large shadow involving the upper left lung field, very suggestive of lung abscess. The upper dorsal spine showed atrophic changes with decrease in space between the bodies.

The patient was afebrile for four days, but the temperature gradually rose to 103–104°. There was considerable cough, with little or no sputum.

Autopsy (No. 2720): The primary tumor appeared to be a small cauliflower-like mass at the bifurcation of the left main bronchus, growing through the wall and extending into the lower lobe.

The right lung was adherent on all sides. The right upper lobe showed extensive tuberculous consolidation and an abscess 2 cm. in diameter, also apparently tuberculous.

The peribronchial nodes were involved, as well as the visceral and parietal peritoneum, the liver, and omentum.

Microscopically the tumor was composed of large cuboidal cells with some tendency
to differentiate into squamous types. The pathological diagnosis was carcinoma of the left bronchus with metastases in the pleura, peritoneum, and liver.

**Case XIX (No. 96575):** S. N., a twenty-two-year-old Italian plumber, was first admitted Jan. 26, 1929, with a history of continuous cough for three months and dyspnea for ten days. He had had similar attacks of cough each of the three previous winters. The cough was severe, with expectoration of mucus and slight substernal distress. There had been a loss of weight of ten pounds. A month before admission the sputum was blood-streaked. It was negative for tubercle bacilli.

The right lung was dull anteriorly from the first rib to the base, with diminished breath and voice sounds and tactile fremitus; no râles. A small area below and outward from the nipple had a slight nasal twang on speaking. Posteriorly on the right from the mid-scapular region to the base was an area of dulness with diminished voice and breath sounds and tactile fremitus; no râles. Substernal dulness was increased, the left border being 5 cm. from the mid-ternal line. The heart was not enlarged. The sputum was repeatedly negative for tubercle bacilli and actinomyces.

The degree of involvement of the mid-portion of the right lung demonstrable roentgenologically would have suggested pneumonitis but for considerable infiltration of the right apex and the right upper lobe which was characteristic of a tuberculous change. The right base of the heart and costophrenic angle were almost completely obliterated. The degree of density in the right base was somewhat suggestive of fluid.

On April 8, 1929, the process on the right was more sharply defined and certainly suggested new growth. The chest was repeatedly aspirated. Guinea-pig tests were negative. The temperature was 100–101° without leukocytosis. The patient was believed to have a lymphosarcoma and was treated by x-ray with some improvement. Later, pressure in the neck became severe and veins over the chest were prominent. X-ray examination, April 23, showed an increase in the involved area, with extension into the left apex. A node removed from the right side of the neck showed carcinoma. Edema of the arms and face developed and on May 13 x-ray films showed marked extension of the tumor on both sides and thickening throughout the upper two-thirds of the right lung, extending out in a cone-shaped mass from the left root. The patient was kept under morphine until death, May 18.

Section (Surgical No. 37772) showed a malignant epithelial growth of undifferentiated cuboidal cells, with no tendency to form either glands or flat sheets of squamous mucous membrane.

**Comment:** Had it not been for the pathological examination of the cervical node, this case would probably have been passed as a lymphosarcoma.

**Case XX (No. 79603):** M. D. A., a fifty-six-year-old Spanish clerk, was admitted March 3, 1930, complaining of aphonia for four months. Since July 1929 he had had a cough with white, non-mucoid, blood-tinged expectoration. The previous April he had had a feeling of pressure in the chest and region of the pectoralis muscles. Before that he had been in good health except for childhood diseases and malaria, influenza during the epidemic, and syphilis thirty-six years before, for which he had had four or five treatments.

Physical examination revealed an area of dulness anteriorly and posteriorly in the upper mediastinum, extending to the midclavicular line on both sides, with diminished breath and voice sounds. A few cervical, inguinal and axillary nodes were palpable; the neck veins were dilated; the larynx was displaced to the left.

The clinical impression was mediastinal tumor. The patient was in the hospital a month, during which time the temperature was normal.

X-ray examination of the chest showed a process extending upward to the spicis and to the periphery. Laryngeal examination showed paralysis of the right arytenoid and right vocal cord. A biopsy, taken bronchoscopically, showed the squamous type of tumor, not well differentiated.

The patient was given two x-ray treatments and then discharged, April 29, to the radiotherapy department. He was again admitted Sept. 20, with severe chest pain and metastatic nodules over the crest of the right ilium and on Poupart's ligament. The veins over the abdomen were prominent. The findings on physical examination were essentially
as before except for extension of dulness and diminished breath sounds. Irradiation of the lesion on the right hip was helpful. Death occurred Oct. 18.

Examination of a minute fragment of growth (Surgical No. 39761) showed this to consist of sheets of spherical cells without differentiation; this might be a portion of a bronchiogenic tumor.

Comment: This case was diagnosed by bronchoscopy but the physical signs and x-ray findings directed attention to the region of the mediastinum, where the mass of nodes from the bronchial carcinoma had caused pressure symptoms. There were comparatively few symptoms from the lung itself.

Case XXI (No. 82765): G. M., a twenty-six-year-old man, was admitted Sept. 30, 1930, complaining of cough for a week and dyspnea for five or six days. The dyspnea first appeared in attacks of several minutes to an hour; finally breathing became continuously labored.

The patient was pale but well nourished and breathed with difficulty. There were no enlarged nodes in the neck. The heart showed no abnormality. The lungs were resonant throughout; breathing was vesicular; there were many coarse râles.

X-ray examination of the chest showed the heart moderately enlarged; there was a rounded widening of the upper mediastinum in the region of the aorta. While such a condition might be due to a dilated descending aorta, it was more suggestive of a deep mass in the mediastinum. The lung fields were clear. On Oct. 6 considerable density was evident in both inner zones, but there was no density to suggest the presence of a mediastinal mass such as was seen in the previous examination. On Oct. 25, examination showed a definite change in the mass originally reported, very suggestive of a mediastinal new growth. On Nov. 1 some increase in involvement of the right hilar region and right base was seen. On Nov. 8 the involvement of the chest was found to be increasing, extending peripherally.

The course in the hospital was febrile throughout, with a few days of normal temperature. For a week, beginning Oct. 1, the patient had a febrile reaction which was taken for consolidation. The physical signs were those of bronchial asthma. The x-ray findings were thought to indicate bronchial pneumonia. On Nov. 22 nodes were made out in the right axilla and later in the left axilla and supraclavicular fossa. Dyspnea was not relieved by adrenalin and ephedrine but the patient improved. A node was excised and carcinoma found.

Autopsy (No. 2937): The right chest contained 50 c.c. of clear fluid, and there were many fibrous adhesions between the lung and the chest wall; also many nodules of tumor on the pleura. The bronchi contained much pus. The mucosa showed frequent ulcerated areas and bronchopneumonia. There was no single mass within the lung parenchyma, nor could it be demonstrated that the tumor had arisen within any one bronchus, as its pleural distribution definitely excluded an origin in any one of the large bronchi.

The left lung was adherent throughout by dense fibrous adhesions, but showed nothing remarkable.

There were many large cervical, axillary, and epitrochlear nodes. Metastases were found in the bronchial and mediastinal nodes, as well as in the retroperitoneal fascia and mesentery.

Microscopically the tumor consisted of large cuboidal cells, undifferentiated, with no tendency to form glands, no mucus, and no papillary arrangement.

Comment: This case is of interest because of the rapidity of the development of the symptoms, which were due to atelectasis of the lung from occlusion of the bronchus, with mediastinal involvement.

Case XXII (No. 83565): C. S., a fifty-eight-year-old American writer, was admitted Oct. 30, 1930, with a history of pain in the right chest for ten or twelve days and dyspnea for seven days. The symptoms began with sharp pain in the right lower chest, which was worse on coughing or moving about. There was no orthopnea and no fever. The patient
was not bedridden but had had to give up work. He complained of loss of appetite for three or four weeks but did not know of any loss of weight. The past history was negative except for colds and sinus trouble.

Chest expansion was limited on the right side, which was flat to percussion. Fremitus was absent. Many fine moist râles were audible over the right apex. The left lung was normal. X-ray examination showed a large effusion on the right side. The left lung was clear.

Successive examinations after repeated aspirations failed to reveal any underlying pathology. A flat density suggesting fluid was always present. There was no anemia; a slight leukocytosis was observed toward the end of the disease. The course was afebrile until the last week in the hospital, when low-grade fever developed. The right chest was aspirated seventeen times and about 15,000 c.c. of fluid removed. The first 7,000 c.c. were clear, the remainder blood-tinged. On Dec. 15, a few tender enlarged nodes were observed in the right axilla. These were removed and found to be carcinomatous and very cellular. The cells were large and irregular with extremely large, occasionally multiple, nuclei. There was a tendency to palisading in some areas. Bronchoscopy was done Dec. 24. No new growth was seen, but the bronchi were filled with tenacious exudate and the mucosa was red. A week before death the liver was found to be enlarged with apparently a smooth surface.

Autopsy (No. 2960): The tumor, which involved the pleural surface especially of the right lung, formed a layer 1 cm. thick over a large portion of the visceral surface. There were 3000 c.c. of clear fluid in the chest. The lung was attached toward the apex and showed atelectasis.

The left lung was edematous, but the pleura was smooth. In the left chest were 100 c.c. of fluid. There was a superficial old tuberculous scar, but no involvement of the bronchial nodes.

Metastases were present in the liver and there were two nodules in the wall of the ileum and jejunum.

Microscopically this tumor consisted of round or somewhat pointed vacuolated cells which tended to line rather large spaces, but it was not certain that these were forming glandular acini.

Comment: This case illustrates well a pulmonary tumor masked by pleurisy with effusion. The extensive pleuritic involvement demonstrable post mortem made it impossible to differentiate the lesion from an endothelioma of the pleura.

Case XXIII (No. 86465): J. W., a sixty-four-year-old motorman, was admitted June 1, 1931, complaining of dyspnea beginning nine weeks earlier with a cold, to which he attributed his illness. For several years previously he had had a chronic cough, with occasional frothy sputum but no pain. There had been gradual loss of strength for four months, more noticeable in the past three weeks, and progressive loss of weight for six months, amounting to 20 pounds. The patient stated that smelling smoke had for years caused him to "lose his breath for an hour or so." He had an occasional cold and sore throat. Dyspnea had been gradually and steadily progressive for the week prior to admission and amounted to orthopnea.

The patient was emaciated and appeared chronically ill. The lungs showed generally diminished resonance with feeble vesicular breath sounds rather more marked at the apices. Medium, rather dry râles were audible over the chest. The cervical nodes were palpable. There was no clubbing of the fingers. The blood count was normal.

X-ray films of the chest showed miliary infiltration of both lungs. Ten days later the miliary shadows were somewhat less discrete, with some filling in between. Examination of sputum was negative for tubercle bacilli, yeast, and streptothrix and an extended search for evidence of malignant disease elsewhere than in the chest, including a gastro-intestinal x-ray series, failed to disclose any abnormality.

The patient had no fever and only moderately increased heart action while in the hospital. He died two weeks after admission.
The ante-mortem diagnosis was disseminated carcinoma of the lung, probably metastatic from some other organ, as biopsy on one of the cervical nodes showed a cellular carcinoma with a few adenomatous areas.

Autopsy (No. 3025): The tumor was found distributed almost uniformly throughout the lobes of both lungs. In each pleural cavity were 800 c.c. of cloudy pinkish fluid, containing some blood and many broken-down cells. There were a few adhesions in the left chest and the base of the right lung was firmly adherent to the diaphragm. There were nodules on the pleural surface of both lungs, as well as throughout the parenchyma of each. The tumor was very extensive, resembling a secondary lesion in its distribution.

Metastases were found in the hilar nodes on both sides. There were nodules in the pericardium and the liver, and in a left cervical node.

Microscopically the growth was of a highly differentiated type with many small branch ing processes and many mucus-producing cells.

Comment: The interest in this case is the disparity between the extensive pulmonary lesion and the meager respiratory symptoms. The original x-ray diagnosis of miliary tuberculosis was negatived first by the absence of fever and of tubercle bacilli and finally by a demonstration of carcinoma in the axillary node. Though miliary carcinoma of the lung has generally been considered to be secondary to disease elsewhere, it is difficult to see how so general a distribution could be effected except by blood stream transmission in the lung. No areas could be found apparently older than the miliary tubercles; the bronchi, both large and of medium size, showed no direct connection with the tumor growth, and a careful examination revealed no carcinoma elsewhere except for metastatic deposits in the liver and hilar lymph nodes. This would seem, therefore, to be a case of primary miliary carcinomatosis of the lung, probably from some small area which could not be distinguished from the mass of miliary infiltration.

Case XXIV (No. 92373): D. R., a fifty-seven-year-old woman, was admitted April 5, 1932, with symptoms dating back two months: cough and slight dyspnea on exertion, a little whitish sputum in the morning. She had no pain in the chest and no night sweats. For a year she had noticed clubbing of the fingers and for five weeks had suffered from severe bitemporal and occipital headaches with dizziness, nausea, and vomiting.

The head was grossly enlarged, with prominent parietal and frontal regions. The heart and abdomen were normal. The fingers were markedly clubbed, the ankles enlarged and puffy, and the wrists broad. The lungs showed diminished resonance and slightly increased breath and voice sounds at the right base, close to the spine.

X-ray examination showed a mass in the lower part of the right lung, slightly smaller and more dense than in a film made prior to admission. X-ray examination of the skull was negative. The tips of the phalanges were flaring, and there was an increase of the soft tissue shadow.

Bronchoscopy showed the mucosa 5 in. below the bronchus division to be pale, with slight constriction from the medial side.

On April 16, eleven days after admission, a first-stage operation was done, the eighth, ninth, and tenth ribs being partially removed. On April 21 the parietal pleura was incised and a discrete tumor, covered by about half an inch of healthy lung tissue was delivered into the wound, and removed by blunt dissection. It was spherical, 5 cm. in diameter, moderately firm, and roughly encapsulated save for a round basal area 2.5 cm. in diameter. From this extended a pyramidal mass of tissue showing a diffuse gray anthracotic pigment. The remainder was yellowish gray, granular and heavily stippled. The patient's condition became so bad that operation could not be completed. Death occurred the same day.

Microscopic examination of the tissue (Surgical No. 43426) showed sheets of epithelium with a definite tendency toward squamous differentiation. There were also areas of papillary adenocarcinoma.
CASE XXV (No. 93229): W. R., a sexton, aged sixty-four, was admitted April 20, 1932, with a chronic cough dating from a year before, when he had been confined to bed with right-sided chest pain, diagnosed as pleurisy. The cough was dry and hacking and small amounts of mucus were expectorated. Several examinations of the chest and roentgenograms had been negative. Following nasal treatment a severe attack of vomiting had occurred with blood and next day the patient complained of pain in the right lower chest. Two days later he had coughed up a teaspoonful of dark blood, following which pain was relieved. After the first hemoptysis the patient had severe dyspnea on exertion and complained of exhaustion. On April 17 there had been a second hemoptysis.

On physical examination the lungs showed normal resonance, vesicular breathing, no râles. The impression was chronic bronchitis with possible pulmonary tuberculosis. X-ray examination showed evidence of a dense band of infiltration at the right base 2 inches wide and probably in the lower lobe. There were no signs of tuberculosis at either apex. A week later there was an increase in density at the right base, which seemed to be due to pneumonia; a fortnight later this had decreased. Four days after this the right lower lobe showed collapse.

On May 10 bronchoscopy was attempted but because of profuse bleeding was deferred until May 17, when the section removed showed small tumor fragments of an epithelial nature. A diagnosis of carcinoma of the bronchus was then made.

The patient was afebrile until two weeks before death, June 3, 1932.

Autopsy (No. 3153): The tumor was in the right main bronchus, 5 cm. from the tracheal bifurcation, the lumen at this point being filled and the wall destroyed by a growth measuring $5 \times 2.5 \times 2.5$ cm. Many of the bronchi throughout both lobes were obstructed and contained much purulent exudate. The right chest contained two liters of greenish fluid, and there were many firm pleural adhesions.

The left lung was relatively free; the pleura was smooth; there was no fluid in the chest on this side, and no tumor was found in the lung.

The only metastases were in the hilar nodes on the right side.

Microscopically the tumor was of a highly differentiated squamous type with some basal areas but with much pearl formation.

Comment: Another case in which the correct diagnosis was made by bronchoscopy.

CASE XXVI (No. 95363): G. P., a fifty-year-old chauffeur, was admitted Aug. 30, 1932. He had been well until two years before. During that period he had had occasional colds, slight hemoptysis a year before admission, and again three months before admission. Cough had been productive for about six months. During the previous year he had lost 14 pounds in weight. Since coming to the clinic two months before admission he had had vague anterior chest pains and occasional fever. Three weeks before admission, tonsillectomy had been done, and four days before admission bronchoscopy with biopsy, showing carcinoma. The temperature was high a few days before bronchoscopy and again after it.

The patient appeared under-nourished and acutely ill. He had an herpetic eruption on the lips and chin and moderate exophthalmos. No enlarged nodes were discovered. The chest findings were as follows: diminished expansion in the right upper lobe; dulness at the apex posteriorly to the first dorsal spine and anteriorly to the third rib, with diminished tactile fremitus there; breath sounds exaggerated, almost bronchial, especially on expiration; increased spoken and whispered voice. In the remainder of the right lung breath sounds and expansion were diminished. There was marked curving of the finger nails from side to side and over the ends of the fingers. The leukocyte count was 11,800 with 54 per cent polymorphonuclears.

X-ray examination showed a dense area at the right apex and a marked reaction in the lung directly opposite the root process, apparently advancing. Later roentgenograms, Sept. 2 and 13, showed no change.

The patient had irregular, fairly high fever for six days, after which the temperature became practically normal, except for an occasional rise to 100°. X-ray treatment was given and the patient was discharged improved. He has since been lost sight of.
CASE XXVII (No. 90542): S. F., a fifty-eight-year-old Russian tailor, was admitted Jan. 11, 1932, with a history of slight cough for years. This had become more marked two weeks before admission and he began to feel weak and lost his appetite. The cough had always been productive of small amounts of white sputum, and on occasions a few drops of blood were noticed. There was no history of night sweats or loss of weight, nor was there any history of syphilis.

The chest findings were negative except for diminished breath and voice sounds over the entire left side posteriorly.

X-ray examination showed a dense circumscribed area in the middle zone of the left lung, just below the lower pole of the lung root. On lateral view it was found to be in the region of the lung root. X-ray examination of the long bones was negative, as was a gastrointestinal series.

On bronchoscopy the left bronchus appeared to be slightly reddened.

The sputum was negative for tumor cells and for tuberculosis on two occasions. During hospitalization the breath and voice sounds showed considerable variation. No râles were heard.

The patient was discharged with a diagnosis of carcinoma of the lung. He was later heard from at another hospital, where a diagnosis of carcinoma of the lung and myocardial degeneration was made.

Autopsy, performed at Montefiore Hospital, showed carcinoma of the left lower bronchus, with abscess formation and chronic emphysema, metastasis to the right lung, liver, left suprarenal, second right rib, lumbar spine, regional and abdominal lymph nodes.

Comment: Another case with a long history of chronic cough.

CASE XXVIII (No. 93429): C. R. W., a Negro boy of seventeen, was admitted April 24, 1932, complaining of aching pains in the feet, ankles, knees, wrists and fingers, of three months' duration, without tenderness, redness, or swelling. There had been some loss of weight. Both the family and past history were negative.

The boy was poorly nourished with extreme osteoarthropathy. The radius and ulna of each arm were enlarged, the distal ends being about one-quarter longer than normal. The hands were very large, and the fingers clubbed. Excessive fluid was present in both knee-joints. Examination of the heart and lungs was negative, but x-ray examination showed a large tumor in the chest which was well encapsulated and not infiltrating the lung tissue. It was thought to be either a dermoid cyst or teratoma. Examination of the skull showed a small sella turcica with no apparent erosion. The long bones showed a periosteal reaction with calcification in layers, typical of osteoarthropathy secondary to chronic pulmonary lesions. The clinical impression was a glandular disturbance with a pulmonary lesion of a benign nature which probably caused the osteoarthropathy.

Several x-ray treatments were given to the upper chest. At this time the patient began to run a temperature, up to 103°, continuing irregularly for six weeks. Pneumothorax was then instituted, preparatory to operation, a total of 1000 c.c. being inserted during three punctures. Meanwhile, as shown roentgenographically, the mass remained about the same, in the mid-portion of the lung in lateral view. The only signs were diminished breath sounds posteriorly on the left. Blood and urine were negative. The patient was transferred to the surgical service and on June 14 the lung was incised and a portion of tumor removed.

Postoperatively the patient became dyspneic and positive pressure in the chest had to be constantly relieved by air aspiration. Later several taps yielded bloody fluid. Death occurred July 23.

Autopsy (No. 3171): There was a fresh surgical incision through the anterior thoracic wall and each pleural cavity was found to contain 1500 c.c. of fluid, that in the right chest being somewhat cloudy and apparently infected, while that in the left was clear.

The tumor occupied a large portion of the right upper lobe and involved many of the bronchi, the right upper main bronchus leading directly into the tumor mass. The growth measured 16 × 12 × 6 cm. It was not encapsulated, though well defined, and was yellowish gray, friable, and comparatively avascular. The peribronchial and tracheal nodes were small. The right lower lobe was atelectatic. The left lung was relatively normal.
No metastases were demonstrated.

Microscopically the tumor consisted of a very extensive papillary growth of small undifferentiated cells with a tendency to arrange themselves in layers on a very scanty fibrous support. These cells resembled somewhat those found in the nasal cavity and also the undifferentiated basal nuclei of the small bronchi. Occasionally groups of cells were formed which assumed a slightly squamous pattern, the cytoplasm being acidophile and greater in amount and the nuclei slightly larger, although usually pale. Mitotic figures were scarcely to be found.

Comment: This tumor is possibly to be regarded rather as a papillary adenoma than as a true malignant neoplasm, but in view of the very extensive invasion of the lung and the groups of cells without any limiting membrane, it seems reasonable to consider it as a carcinoma.

The case is of unusual interest because of the complete absence of pulmonary symptoms and physical signs, the mass in the lung being discovered only in the course of a routine x-ray examination. Until then the entire attention was focused on the problem as a glandular one.

Case XXIX (No. 936777): S. v. O., a fifty-year-old clerk was admitted June 4, 1932. For years he had had a slight cough with profuse expectoration but he was able to do his work. Five weeks before admission he began to feel weak in the legs and to have severe pain in the lumbar region. A week later he was unable to walk.

On admission the patient was emaciated and suffering from severe pain in the lumbar and sacro-iliac region. There was marked dulness over the upper two-thirds of the right chest with harsh breath sounds and voice sounds almost bronchial. Moist râles were audible at the right apex after coughing. The left epididymis was enlarged. There was a doubtful mass in the left flank. The fingers were not clubbed. The impression was general carcinomatosis or generalized tuberculosis, involving the lung, spine, peritoneum, and bone.

X-ray examination showed consolidation of the upper half of the right lung; left lung clear; collapse of the lumbar vertebrae and beginning involvement of the upper border of the fifth; no evidence of tumor in the kidneys.

The final clinical diagnosis was carcinoma of a bronchus.

The patient ran a moderate temperature while in the hospital, requiring morphine continually for the pain. Death occurred June 27, three weeks after admission.

Autopsy (No. 3161): The tumor was a hard nodular mass which had probably arisen from the right upper main bronchus and almost completely involved the right upper lobe. The lobe was densely adherent to the mediastinum and the parietal pleura. A mass of nodes at the hilus measured $5 \times 5 \times 4$ cm., but there was no fluid in the pleural cavity.

The left lung and other organs were not examined.

The only metastases observed were at the hilus of the right lung.

Microscopically the tumor was of a highly differentiated squamous type with many pearls and characteristic malpighian layers.

Comment: An excellent example of bronchial carcinoma with a practically symptomless course presumably of years' duration; hospitalization for metastasis to the vertebra and consequent pain.

Case XXX (No. 88051): W. K., a twenty-seven-year-old artist, was admitted Sept. 7, 1931, complaining of pain in the right chest for four weeks, first appearing two days after tooth extraction. An x-ray film was interpreted as an abscess of the lower lobe of the right lung. The pain disappeared but reappeared in three weeks, radiating to the right shoulder. It was accompanied by some dyspnea but no cough or sputum. The patient had had asthma all his life and was definitely sensitive to egg and aspirin.

Except for abundant sibilant and sonorous râles the chest examination was negative. The patient had some fever and x-ray examination showed a rounded dense swelling in the right hilar region, with some enlargement a month later.

Bronchoscopy was advised but the patient was discharged to attend to some business
matters. He was readmitted June 20, 1932, with a history of some cough and blood-streaked sputum, never foul, for six months, but this showed a tendency to clear up. He had also had attacks of suffocation and fainting, and for the past five weeks had noticed swelling of the fingers and wrists with pain, worse during the attacks of suffocation. There were also some pain and swelling in the feet, but less marked. The urine had sometimes been cloudy. Neocinchophen relieved the pain and swelling; the latter was thought to be purely mechanical.

X-ray examination showed the tumor to be five times as large as on discharge, still fairly well outlined. The hands and feet showed no bony changes. The tumor mass was felt to be largely anterior, where there were flatness and absence of breath and voice sounds. Posteriorly there were signs of pulmonary compression. The patient had severe attacks of pain and suffocation requiring large doses of morphine. He went downhill rapidly and died from suffocation, July 23, 1932.

Autopsy (No. 3170): The tumor had so extensively involved the right lung and pleural cavity that the chest was asymmetrical, the right side bulging forward and forcing the liver downward, so that the entire right side of the body appeared larger than the left.

On opening the chest 500 c.c. of clear fluid was found in the right pleural cavity. The lung had become densely adherent over the third rib, which was eroded, and an extremely large mass of white nodular growth, soft and friable, showing some necrosis and weighing 2200 gm., replaced most of the right lung. This tumor was most extensive in the upper lobe. The right upper main bronchus was infiltrated, and such portions of it as remained were filled with a fungating tumor mass.

The left lung was free. There was no fluid in the chest, and the parenchyma showed congestion only. There were metastases to the hilus nodes.

Comment: A case unusual for the rapid growth of the tumor.

CASE XXXI (No. 98957): F. Z., a forty-year-old Italian, was admitted March 28, 1933. Three weeks before admission he had begun to have severe pain in the right chest not definitely associated with breathing. Cough developed later. Except for an attack of pleurisy eighteen years earlier the past history was irrelevant.

Physical examination showed a well developed thorax, with the intercostal spaces over the right base filled out. There was marked tenderness over the ninth and tenth ribs with flatness and distant breath sounds at the right base as high as the lower angle of the scapula; no râles. The heart and mediastinum were shifted to the left. The clinical impression was fluid in the right pleural cavity, due either to tuberculosis, neoplasm, or syphilis.

X-ray examination disclosed a large effusion on the right side. On April 3 examination showed marked destruction of the anterior ends of the eleventh and tenth ribs. There was no change in the fluid level since the preceding examination. Expansion of the ribs and absence of new bone formation were regarded as very suggestive of neoplasm.

On April 4 operation was done for removal of the rib lesion. A small mass was found over the ninth and tenth ribs extending to the costochondral junction. The ribs were completely destroyed at this point. There was considerable fluid in the pleura. Tumor tissue was removed with the curet.

During a two months' stay in the hospital the patient ran an irregular temperature, 101–102°, highest at night. He complained of pain in the side, and had a cough with slight muconpurulent expectoration and frequent night sweats. In spite of radiotherapy he gradually failed in strength and died May 3, 1933.

The section (Surgery No. 45295) showed a small amount of malignant tumor derived from some epithelial surface, showing a high degree of differentiation, some parts being definitely squamous with pearls and keratinized areas, while others showed a tendency toward papillary growth. The diagnosis was carcinoma of the rib of bronchiogenic origin.

CASE XXXII (No. 95688): J. G., an accountant, sixty-seven years old, was admitted Oct. 4, 1932. His chief complaint was gradual progressive loss of strength, for no obvious reason, for twelve months, with a loss of weight of 40 pounds. His appetite was good, and he had no pain and no jaundice. For several years he had had a chronic cough which he
was told was due to bronchial trouble. There was no history of expectoration, hemoptysis, chest pain, dyspnea or orthopnea. The past history was not significant.

Chest examination showed normal resonance; bronchovesicular breath sounds below the third rib and above to the axilla; a few crackling rales at the right base posteriorly; no enlargement of the heart. The abdomen was distended as the result of tremendous hepatic enlargement. The liver extended well into the pelvis on the right, and the left lobe into the flank; the surface was nodular; no tenderness. The clinical impression was generalized carcinoma, primary focus unknown; metastatic carcinoma of the liver.

X-ray examination of the chest showed at the level of the aorta on the right a large mass evidently pushing out from the mediastinum; lower down was a dense mass infiltrating the lung from the pleura. A gastro-intestinal series was negative.

Ten days later x-ray examination showed the large mass more circumscribed than at the earlier examination. Gastric analysis showed free hydrochloric acid 37. There was no fever. The left vocal cord was paralyzed due to recurrent paralysis of the laryngeal nerve.

The urea nitrogen was 26.2 and 43.2 on successive examinations. Death occurred, apparently from uremia, nineteen days after admission, Oct. 22.

Autopsy (No. 3199): A very large mass of tumor superficially resembling the stage of grey hepatization occupied the upper portion of the right lower lobe. It showed no connection with the largest bronchi, but many of the smaller ones were definitely involved in it. The right lung was adherent throughout and there were many mediastinal nodes at the bifurcation of the trachea.

The left lung was adherent by old fibrous adhesions, but was relatively normal on section. There were metastases to the abdominal nodes and liver. Microscopically the tumor was composed of very small undifferentiated oval cells with no tendency to form glands or squamous changes.

The diagnosis was primary pulmonary carcinoma; secondary carcinoma of liver; chronic nephritis; chronic myocarditis; perisplenitis.

CASE XXXIII (No. 102874): J. W., a sixty-eight-year-old Austrian baker, was admitted Nov. 27, 1933, with a history of paroxysmal cough of insidious onset for three months, with scant mucoid expectoration but no hemoptysis, dull aching pain in the right sternal scapular region, loss of weight of 28 pounds, and moderate fever.

On physical examination the fingers showed beginning clubbing. The lungs gave normal resonance in the right axilla between the second and fifth interspace. In the region of the middle lobe were numerous high-pitched musical rales. There were two hard masses in the right side of the neck, something more than a centimeter in diameter.

X-ray examination, Nov. 28, showed a shadow in the right side of the chest, without fluid; on Dec. 11 fluid was demonstrable. Bronchoscopy showed normal mucous membranes. The impression was bronchial carcinoma.

In December the patient developed a pleurisy with effusion, first with clear and later with bloody fluid. Biopsy of a cervical node showed carcinoma. The temperature was slightly elevated. The course was progressively downhill and death occurred Jan. 16, 1934.

Autopsy (No. 3403): The right lung was adherent to the ribs, especially anteriorly. There were 600 c.c. of fluid in the right pleural cavity, and a tumor mass occupied the right upper lobe, originating near the hilus, and narrowing and invading the wall of the primary bronchus to the upper lobe. The wall of the trachea and the pericardial sac were both infiltrated. There were several nodules on the pleural surface over the diaphragm.

The left pleural cavity contained 600 c.c. of clear fluid. The pleura was smooth, but the lung showed no tumor.

There were metastases in the mediastinal and mesenteric nodes and in the liver. Microscopically the tumor was a very cellular growth of small spherical epithelial cells with large nuclei and very scanty cytoplasm. They invaded the alveolar septa, filling the air spaces and growing around the alveolar walls.

CASE XXXIV (No. 103314): G. W., a man of fifty-seven, was admitted Feb. 7, 1934, after an illness lasting one year. This had begun with an upper respiratory infection, with malaise and fever, confining him to bed for two days. He returned to work, but four days
later developed a hacking cough and an evening temperature of 102–105°, which lasted five
days and then cleared. The cough persisted and more recently there had been foul, fetid
sputum. There had been a loss of weight of 45 pounds. The previous illness was inter-
preted as a pneumonia and since bronchoscopic examination elsewhere had shown an abscess
cavity, the clinical diagnosis was post-pneumonic abscess.

Physical examination showed dulness over the lower half of the left chest; tympanites
above. Roentgenograms showed a cavity with free fluid. Pus was obtained on exploration.

A thoracotomy was done with drainage and rib resection. Carcinoma was unsuspected
until the end. The patient died March 10.

Autopsy (No. 3437): The tumor was found in the left lower lobe, close to the hilus,
with fan-shaped radiation along all the bronchi in this lobe. There was an abscess cavity
3 x 3 x 6 cm. in the lower lobe. The pleura was much thickened.

The right lung was edematous; the surface was smooth, and there was but little
congestion.

Metastases were found in the liver and the mediastinal and mesenteric nodes.

Microscopically the growth consisted of cuboidal cells with a slight tendency toward
papillary as well as squamous differentiation. The final diagnosis was carcinoma of the
lung with abscess formation.

Comment: Another of the numerous cases in which abscess of the lung
obscured the underlying carcinoma.

Case XXXV (No. 105433): A. K., a forty-six-year-old porter, was admitted May 24,
1934, with a three weeks’ history of cough, chills, and fever, but no pain. The sputum was
yellowish and mucoid, with no hemoptysis; dyspnea followed exertion; there had been 7
pounds loss of weight in four weeks. The patient had had influenza seventeen years pre-
viously, but no subsequent history of respiratory disturbances. He was a heavy smoker.

In the lower right posterior chest, close to the spine, the breath sounds were diminished.
The liver edge was palpable two fingers below. The prostate was normal. There was no
clubbing of the fingers.

X-ray examination on May 24 showed a large, dense, sharply circumscribed shadow on
the right side, and this was unchanged on June 7.

Bronchoscopy showed the bronchus of the middle lobe to be contracted. Gastro-
intestinal examination was negative. The patient ran a mildly febrile course and was dis-
charged in June. The diagnosis was bronchial carcinoma.

After frequent x-ray treatments, the patient was readmitted Nov. 26. Roentgenograms
now showed a much larger mass, and death occurred Jan. 17, 1935.

Operation had been considered on the first admission but, owing to the proximity of
the mediastinum to the shadow, it was thought that the disease was too far advanced for
radical surgery.

Autopsy (No. 3593): The right chest contained 1500 c.c. of thin cloudy fluid, and
showed a few pleural adhesions. The tumor occupied a large part of the right upper lobe,
arising from the hilus of this lobe and compressing and filling the main bronchus. The mass
measured 8 x 11 cm., and was grayish or yellowish; an area of gangrene of the lung paren-
chyma was present in the lowest portion of the lobe below the tumor. There were nodules
on the visceral pleura and on the diaphragmatic surface. A mass of nodes at the hilus meas-
ured 5 x 3 x 3 cm. The upper lobe showed bronchiectasis and was edematous.

The left chest contained 200 c.c. of fluid. The upper lobe was congested, and the lower
lobe showed bronchopneumonia, with no tumor.

There were metastases to both adrenals.

Microscopically the tumor showed a polymorphous structure in some areas, faintly
suggesting a squamous type of epithelium. In other parts, and especially in the metastases
in the adrenals, the cells were extremely large, often with multiple nuclei; they remained
detached and showed no gland formation or squamous character.

Case XXXVI (No. 60093): A. C., a sixty-four-year-old woman, was admitted Jan. 23,
1935. A year earlier she had had a bad cold with pain in the right shoulder, which sub-
sided in six weeks. Again, five months before admission she had a slight cold which ended
with a persistent dry cough and was followed by a return of pain in the right upper chest which was sharp and stabbing in character. The pain, which was described as going through the chest from front to back, just above the right breast, became progressively worse, so that the patient would press upon the chest while coughing to obtain relief. A month before admission she was given some medicine to relieve the cough but the pain persisted as a constant dull ache. Two weeks before admission she had pain in the upper half of the right breast with a sense of fulness in the right axilla. She had lost 17 pounds during the year. There was no history of hemoptysis, expectoration, or night sweats.

Examination revealed dulness in the outer half of the first and second right spaces, with diminished breath sounds; fremitus normal; no râles. There was slight hyperesthesia over the third and fourth ribs and the corresponding spaces of the right chest anteriorly.

X-ray examination showed a wedge-shaped area of density in the right upper lobe, somewhat suggestive of atelectasis. Films taken by the patient’s own physician a year earlier showed the same type of shadow but less dense. For this reason the shadow was thought to have been due to the tumor rather than to the atelectasis.

Bronchoscopy failed to reveal any evidence of growth or narrowing of the bronchi.

There was a history of removal of a carcinoma of the cervix seven years before. The clinical diagnosis was uncertain as between a metastasis or a primary pulmonary tumor. No other metastases or other lesions could be made out on thorough examination, including a gastro-intestinal series.

It was decided to operate, whether the lesion were primary or secondary. Following preliminary pneumothorax, operation was performed Feb. 20. As the middle lobe was also infiltrated, instead of the proposed lobectomy, a pneumonectomy was done. The patient did well for two months and three months after operation was discharged. She died in the country, late in the summer.

Histologically the growth was a bronchiogenic carcinoma.

The tumor (Surgical No. 48869) originated in the right upper lobe, forming a mass 6.5 × 4 × 7 cm., adherent anteriorly to the third rib, the periosteum of which was infiltrated. It could not be determined in which bronchus this tumor originated. There were pleural metastases and bronchial node metastases.

The sections show large cuboidal cells, but also sheets of cells with some squamous differentiation, with much necrosis and fibrosis around them.

Comment: A case of bronchiogenic carcinoma with symptoms of a year’s duration; pneumonectomy.

CASE XXXVII (No. 103384): L. W., a fifty-seven-year-old male, was admitted Nov. 15, 1933, with a diagnosis of superior sulcus tumor. There was a history of pain and weakness in the right arm for one year, but no respiratory symptoms.

Physical examination showed Horner’s syndrome, myosis of the right pupil and narrowing of the right palpebral fissure. The supravacular lymph nodes were large and hard. There was dulness at the apex of the right lung, with diminished breath sounds but no râles. The eye grounds showed slight congestion. There was hyperesthesia on the anterior surface of the forearm and palm; hypesthesia elsewhere.

The x-ray film showed a shadow in the upper right mediastinal zone. The course was afebrile. Cordotomy was considered to relieve pain. Repeated x-ray treatment gave no relief of symptoms.

The patient was readmitted April 2, 1934, with a history of cough for ten days prior to admission. The signs at the apex were more pronounced than before, and there was extension of the x-ray shadow. By the middle of April there were signs of fluid in the right chest. Death occurred May 19.

Autopsy (No. 3472): The right chest contained 600 c.c. of greenish fluid. The lung was densely adherent posteriorly and anteriorly. The tumor was primary in the right upper lobe, invading the middle and lower lobes by way of the lymphatics.

The left chest contained 500 c.c. of greenish fluid; the left lung was edematous.

There were metastases in the cervical, mediastinal, and bronchial nodes, and the roots of the brachial plexus, and infiltration of the periosteum of the first, second, and third right ribs posteriorly.
Microscopically there was considerable gland formation and small papillary branches were seen; also diffuse infiltration with cuboidal cells and sclerosis.

Comment: An unusual type of case with Horner's syndrome and pain of the type which has been described as due to an upper sulcus tumor.

Case XXXVIII (No. 108440): D. C., a man of fifty-three, who had been employed as a street-worker and in cleaning steel parts on an emery wheel, was admitted Dec. 14, 1934, with history of pain in the left side of the chest for six months. He had coughed for years, but otherwise the past history was not significant. He had noticed slight blood-streaking of the sputum since May 1934. The left upper anterior chest was hyperesthetic with "pins-and-needles" sensation.

The apices were retracted, and there was moderate dulness over the left posterior chest between the fourth and eighth spines. Breath sounds were diminished. There was no clubbing of the fingers.

X-ray examination showed infiltration of the upper pole of the left root and along the course of the upper inner bronchus, which increased while the patient was in the hospital. The diagnosis was bronchial carcinoma.

Bronchoscopy was negative. There was a left recurrent laryngeal paralysis.

Cordotomy on Jan. 18, 1935, relieved the pain, for which morphine had previously been necessary.

Autopsy (No. 3614): The tumor occupied the hilus of the left lung, encircled the main bronchus to the upper lobe, and radiated to the apex. There were 200 c.c. of clear fluid in the left chest. Numerous small abscesses were present in both upper and lower lobes, and a mass of nodes was adherent to the muscular wall of the esophagus, but did not infiltrate its mucosa.

The right chest contained no fluid, the pleural surfaces being densely adherent throughout. The upper lobe of the right lung contained several nodules and thin-walled cavities.

No metastases were found other than those in the mediastinum.

Microscopically the tumor was a highly differentiated squamous growth with many cells of the malpighian layer and small amounts of keratinization.

Comment: A case of uncontrollable pain due to bronchial carcinoma, relieved by spinothalamic section.

Case XXXIX (No. 109286): C. C., aged sixty-five, was admitted March 22, 1935. This was his fourth admission. At the first a left hydrocele was tapped; at the second, the tunica vaginalis was excised and the hydrocele cured; at the third hemorrhoidectomy was done.

The chief complaint was shortness of breath of three months' duration. At the same time the patient had had a cough, and had raised about half a glass of yellow-white sputum. There was no hemoptysis. For the past three weeks the dyspnea had become worse and the patient was now orthopneic. He had pain in the right lower chest anteriorly on inspiration and complained of constant pain in the left upper quadrant of the abdomen. There was some question as to loss of weight. No mention was made of osteoarthropathy.

The lungs were dull on the left side posteriorly from the third to sixth rib, but resonant elsewhere. Breath sounds were bronchial in the area of dulness; also over the right chest posteriorly from the third to the fifth rib and at the apex. Over the apex the breath sounds were almost amphoric. The clinical impression was arteriosclerotic heart disease, auricular fibrillation, pulmonary tuberculosis, and osteoarthritis.

X-ray examination of the chest showed considerable fibrosis throughout both lung fields, most marked on the right, increased at the apex, and suggesting the fibrotic type of tuberculosis.

The patient had a fever, 100-101° and moderate leukocytosis. Death, March 24, was due to circulatory failure.

Autopsy (No. 3628): There was no fluid in either chest. The tumor had apparently arisen from the eparterial bronchus at its origin and infiltrated extensively, including the en-
tire circumference of the pulmonary artery, forming a mass 6 × 4 cm. A small cavity 4 cm. in diameter occupied the apex of the right lobe. The middle lobe was relatively normal, and the lower lobe edematous.

The left lung was congested, with a cavity 2 cm. in diameter in its upper lobe.

Numerous anterior mediastinal nodes were infiltrated by tumor.

Microscopically the tumor was made up of sheets of undifferentiated cells varying from cuboidal to basal, with only a slight suggestion of squamous differentiation.

CASE XL (No. 109415): H. K., an Armenian, sixty years old, was admitted March 15, 1935. He had caught cold four weeks before, and complained of cough and generalized aches and pains. There was no history of hemoptysis or dyspnea. A few days after the onset of the illness involuntary twitching of left arm had occurred, first clonic, then tonic; contractions were limited to the arm and hand. Three similar attacks of jacksonian-like epilepsy had since occurred, with progressive weakness of the left arm and the left leg until on admission walking was impossible without aid.

Physical examination showed: bilateral nodes of moderate size in the neck; visual fields normal; lungs negative. There was an enlarged nodule in the right upper abdominal quadrant, not tender. Considerable groups of inguinal nodes were palpable bilaterally. There was slight clubbing of the fingers. The first impression was of multiple sclerosis, central nervous system metastasis, brain tumor and encephalitis, cirrhosis of the liver, or syphilis of the central nervous system.

X-ray examination showed chronic thickening of the lung fields on both sides, particularly at the left apex, where there was some infiltration and contraction, drawing the trachea to the affected zone. The appearance was suggestive of an old fibrotic tuberculosis. Examination of the chest stereoscopically showed a band of infiltration extending from the upper pole of the left root, upward and backward to the periphery. Near the periphery was evidence of cavitation.

Bronchoscopy failed to demonstrate a lung tumor. There was mucus in both the right and left bronchi.

The spinal fluid was negative. The neurologist favored a diagnosis of cerebral metastasis of malignant disease or multiple sclerosis.

Later the right kidney became palpable under an enlarged liver and a hard, fixed mass, 2 × 3 cm., was observed in the middle of the left side of the abdomen. It seemed to be a tumor involving the left kidney, as no kidney was palpable in the usual site. Two days later pigmentation of left buccal mucous membrane was discovered which suggested the possibility of an adrenal disturbance. On the whole, however, the clinical impression was probable neoplasm of the lung or of the adrenals with cerebral metastasis.

Autopsy (No. 3634): The body was much wasted, the deltoid muscle especially showing atrophy. There was also marked clubbing of the fingers and toes, but no superficial nodes were involved.

The tumor occupied the left upper lobe in the posterior portion, where there were considerable softening and abscess formation; also dense adhesions to the thoracic wall. No connection could be made out with any large bronchus. The remainder of the lobe showed extensive bronchopneumonia. The lower lobe was congested. The small bronchi were filled with muco-pus.

The right lung showed congestion and edema, but no tumor.

There were numerous metastases in the brain, where a large nodule was present in the right rolandic gyrus, and metastatic growths were found in both adrenals, the liver, diaphragm, and mesenteric nodes.

Microscopically the growth was polymorphous, containing some spindle cells and other large multinuclear cells.

Comment: Case illustrating the difficulty of determining the primary site of malignant disease, with symptoms pointing to brain, adrenals, and lung.

CASE XLI (No. 110010): B. B., a secretary fifty-one years old, was admitted April 10, 1935, with a history of dyspnea for two years, probably of cardiac origin, as the patient had
coronary sclerosis and anginal symptoms. Three months before admission she had collapsed and fallen, hitting the right side of the chest. During the ensuing five weeks, which she spent in bed, she was exceedingly dyspneic and suffered severe pain in the right lower chest, not aggravated by respiration or coughing, but augmented by lying on the right side. She had lost 20 pounds in weight. Three weeks before admission cough and chest pain became more severe. There was no hemoptysis and no osteoarthropathy.

The chest showed diminished expansion on the right, dulness, and diminished fremitus. X-ray examination showed the heart displaced to the left, presumably by pleural effusion on the right. Aspiration yielded serosanguineous fluid which did not produce tuberculosis in the guinea-pig. It was, therefore, regarded as probably due to malignancy, either endo-thelioma or bronchial carcinoma, the latter proving correct. Death occurred June 13.

**Autopsy**: The right pleural cavity was obliterated by adhesions and there were calcified bronchial nodes and an old apical scar on the right. There was no tumor to be found in or around the main bronchi, the neoplasm being mostly on the surface, thus resembling a primary tumor of the pleura. The nodes at the right hilus appeared involved by the tumor, and there were many nodules covering the pleural surface of the right lung.

The left lung was free and the pleura smooth, except for adhesions around a calcified tubercle in the lower lobe. There were congestion and edema, but no evidence of tumor.

Metastases were limited to the hilar nodes.

Microscopically the tumor grew in some areas in medullary fashion, but was in part papillary and glandular, with the production of small quantities of mucus. It involved the peripheral air spaces and invaded the lymphatics of the pleural surfaces.

**CASE XLII (No. 110567)**: P. P., a Greek barber, sixty-nine years old, was admitted June 3, 1935, with two years' history of cough and expectoration, worse during the past two weeks, with malaise, fever, and diarrhea. The sputum was greenish.

Physical examination showed dulness over the lower left lung and slight dulness at the left apex, extending to the axilla; sticky, moist, crackling râles over the left chest anteriorly; fewer râles posteriorly; no clubbing of fingers. X-ray examination revealed patchy density. The impression was tuberculosis or malignancy. Bronchoscopy was not done.

Death took place three days after admission. The temperature during the stay in the hospital ran from 99 to 105°.

**Autopsy**: There was no fluid in either pleura; there were fibrous adhesions on the left, especially in the lower half. The tumor was medial, at the left hilus, at the bifurcation of the left main bronchus, and measured 5 X 4 X 5 cm. Both main bronchi on the left were stenosed, but not entirely obstructed. The lower was most narrowed, and the lobe showed bronchiectasis and confluent bronchopneumonia.

The right lung showed congestion.

Microscopically the growth showed sheets of squamous cells with some keratinizing cells and a predominance of malpighian cells. The nodes at the hilus were involved.

**CASE XLIII (No. 267649)**: J. C., a thirty-nine-year-old salesman, was admitted Aug. 14, 1935, complaining of loss of voice and cough since an attack of influenza four months before admission. He had had frequent chills followed by fever for the past three months. Up until two days before admission he had pain only on dark days, on deep inspiration, and not of a sharp character. The pain had now become much more severe. It was located in the left lower chest, was not particularly modified by respiration, and was accompanied by dyspnea and orthopnea. The sputum had been thick but never blood-streaked. Repeated examinations for tubercle bacilli were negative until one day before death.

Physical examination revealed a widened mediastinum, dulness at the left base, diminished breath sounds, voice, and fremitus. The chest was twice tapped, yielding a small amount of slightly yellow, turbid fluid. Cultures gave no growth and guinea-pig inoculation was negative. There was no clubbing of the fingers.

X-ray examination showed a mediastinal shadow displacing the trachea and also a shadow at the left base and later a shadow of pneumonia on the right.

Laryngoscopic examination showed at first paralysis of the right and then the left vocal cord. Bronchoscopy on Sept. 18 revealed pressure from an extratracheal mass on the right and pus in the left lower bronchus, but no other lesion could be demonstrated.
The patient had fever from the day of admission until Sept. 16; the temperature was then normal until Oct. 1. The leukocyte count was continuously high, 14,000–20,000, with a relative increase in polymorphonuclears. During hospitalization an adenitis developed in the left axilla and the left supraclavicular nodes; the latter disappeared. One of the axillary nodes was excised and showed chronic inflammation.

The clinical diagnosis was a mediastinal mass, but it was uncertain whether this was attributable to Hodgkin’s disease, lymphosarcoma, tuberculosis, or a neoplasm of the lung with secondary mediastinal nodes.

The course in the hospital was gradually downhill, with increasing pain requiring morphine, and dyspnea due to pressure on the trachea. Death occurred Oct. 18, 1935.

Autopsy (No. 3740): The tumor occupied the base of the left lower lobe and measured 4 to 5 cm. in diameter, with fibrous adhesions, especially to the anterior chest wall. It had metastasized to the right lung and the peribronchial nodes. Other organs were not examined.

Microscopically the tumor consisted of sheets of cuboidal and columnar cells, many of which were swollen with globules of mucus. Whole groups of cells were undergoing mucoid degeneration. There was practically no gland formation.

CASE XLIV (No. 109272): J. B., a forty-two-year-old Hollander, was admitted March 31, 1935. In 1918, while in the army, he was sent into an experimental gas chamber (probably mustard gas), and because of a leaky mask was overcome for a few days. He recovered rapidly, however, and during the rest of his time in the army was able to engage in ordinary sports. In 1922 he had what was called double pneumonia and since that time had had asthma and repeated attacks of pneumonia in the left upper lobe.

The patient had been seen at the hospital several months earlier with what was apparently a left upper lobe pneumonia, the signs of which never completely cleared up. In spite of the fact that he was fever-free after a number of months, he was kept under observation. Bronchoscopy was done with negative results. An attempt was made to inject lipiodol but this completely failed to penetrate the upper lobe. The injection was repeated with a bronchoscope, and under the fluoroscope the contrast medium was seen to enter the upper left stem bronchus, but was at once returned without penetrating to the lung.

Diagnosis was made of obstruction to the left upper stem bronchus. Pneumothorax failed to detach the left upper lobe from the pleura in its entirety, so that the collapse was incomplete. On June 5 exploration was done, incision being made in the third space from the scapular line forward to the sternum. The upper lobe was adherent at the apex and everywhere else except on the mediastinal surface. Close to the hilus a mass of an indefinite nature was felt and it was decided to do a lobectomy. In freeing the pleura an abscess cavity was opened.

The excised lobe showed atelectasis, fibrosis, and numerous areas of infection, but no carcinoma, even in frozen sections from the immediate area of the stump. Pieces removed from the stump, however, showed bronchial carcinoma in frozen section. Pneumonecetomy was performed and the main bronchus severed close to the bifurcation and palpable mediastinal nodes were removed. During the operation both pericardium and mediastinum were opened. The bronchus was sectioned about 0.5 cm. proximal to the growth, the main occlusive lesion being 1 cm. from the left upper stem bronchus.

The patient did well until fifteen hours after operation, when edema of the lungs appeared. In spite of stimulation with glucose, he continued to go downhill and died twenty-six hours after the conclusion of the operation (June 6). Marked positive pressure did not exist in the chest or in the pericardium as was proved by aspiration with a needle.

Autopsy (No. 3684): The tumor was in the left upper lobe and appeared to have arisen from the main bronchus to this lobe, forming a small mass in and around the branches of the bronchus. There were atelectasis and abscesses in the collapsed lung distal to the obstruction. The hilus nodes were involved. There was no fluid in the chest before operation.

Microscopically the cells were large and undifferentiated, with large vesicular nuclei. There was no differentiation into squamous or glandular type.

Comment: This seems to be the case in our series which should have been most responsive to radical treatment. Unfortunately, a positive diagnosis
could not be made prior to operation and a lobectomy was performed for removal of the atelectatic lobe before the presence of carcinoma could be demonstrated. The subsequent pneumonectomy was too great a strain.

**Case XLV (No. 51785):** C. N., a chauffeur aged thirty-seven, was admitted Nov. 28, 1925, with pain in the right side, weakness, and shortness of breath. Ten weeks earlier he had experienced a sharp, sticking pain in the right side, aggravated by respiration, and this had persisted up until the past month, when it was replaced by a sense of soreness with acute pain only on cough and deep inspiration. There had been a loss of weight of 17 pounds, dyspnea for a few weeks, and persistent cough with expectoration. There was no evidence of osteoarthropathy, and no history of chills or fever. Strapping had relieved the pain. Moderate hemoptysis had occurred, which the patient believed to be of nasal origin.

The skin over the middle right chest was reddened. There were diminished respiratory movements on the lower right side and diminished tactile fremitus on respiration at the right base. Below the fourth rib anteriorly and below the angle of scapula on the right side were dulness, absence of breath sounds and diminished voice transmission. Otherwise the lungs appeared normal. Abdominal findings were negative and there was no evidence of adrenal disturbance. The clinical impression was pleurisy with effusion.

The patient had slight fever on admission but in December the temperature became normal and remained so until February, never rising higher than 101°F.

Repeated x-ray plates showed only the obliteration due to fluid, until March, when evidence of hilar infiltration on the opposite side of the chest appeared. Aspiration was performed, yielding fluid with a low cell count (5 per cent neutrophils), specific gravity 1.020, Esbach test 14. It was negative on guinea-pig inoculation.

Biopsy of an axillary node showed carcinoma.

The patient gradually failed and died May 5, 1926.

**Autopsy (No. 2295):** The left chest contained 100 c.c. of bloody fluid; there was less in the right. The tumor appeared to be primary in the right lower lobe, but invaded both lungs, and there were cavities in both upper lobes. There were extensive pleural metastases on the right side and a large tumor involving the 10th to 12th ribs on the right. The pleura was adherent throughout on the right, and to the diaphragm on the left.

Metastasis had occurred to both adrenals, the ribs, the left pleura, liver, and mediastinal fascia and nodes.

Microscopic slides showed a sclerosing tumor with cells only slightly suggesting an origin from squamous epithelium. Most of them were arranged in sheets. A few suggested glandular arrangement.

**Case XLVI (No. 92134):** J. J., a checker, fifty-five years old, was admitted April 9, 1932, complaining of weakness, loss of weight, and cough. He had caught cold six months earlier and gave a history of pleuritic pain for four months, sputum in large amounts, dyspnea on exertion, loss of weight of 30 pounds since November 1931; blood-streaked sputum for the first three days of the pleuritic attack. The temperature was 100.8°F. There was no clubbing of the fingers.

The patient appeared emaciated. The right supraclavicular nodes were enlarged; the right chest was dull with limited expansion, and flat below the sixth spine posteriorly. Breathing was diminished below, bronchial above. Many moist râles were audible. The heart was displaced to the left. A mass was present in the upper abdomen.

X-ray examination showed density of the right chest due to effusion. Aspiration yielded 1600 c.c. of fluid and a solid mass was encountered beyond. The impression was bronchial carcinoma. The patient died on the third day in the hospital.

**Autopsy (No. 3134):** The tumor occupied almost the entire right chest, the right upper lobe appearing to be the site of the primary growth with direct infiltration of the cervical nodes on the right side. The mucous membrane of the right main bronchus was invaded but the tumor was so large that no one bronchus could be considered its source.

The left lung was free, very edematous, and showed tumor nodules on the pleural surfaces. There were metastases in the left pleura, left kidney, and cervical and retroperitoneal nodes. Microscopically the tumor was made up of small undifferentiated cells.

Agricola, Johannes: De Re Metallica, 1556.


Curran: Cited by Steffen.


Hare, E. S.: Tumour involving certain nerves, London M. Gaz. 1: 16, 1838.


MORGAGNI, J. B.: De sedibus et causis morborum, 1766, lib. ii, ep. 22.


