Benign Tumors of the Lung*

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Benign tumors of the lung and bronchi remain rare even though attention has been drawn to them in recent years as a result of improved diagnostic and surgical techniques. The most frequent among them are the adenomas, whose benign character has recently been a matter of controversy, and the hamartomas. Much less frequent are reports of lipomas, chondromas, leiomyomas, neurinomas and papillomas. The present material consists of patients treated in the department of Thoracic Surgery of the Tel Hashomer Government Hospital during the years 1950-1960, in all of whom (excluding one in whom there was a clinical course most typical of adenoma) the diagnosis was confirmed by histologic examination.

During those years, 264 operations were performed for tumors of the lung, among them 18 adenomas, ten hamartomas, two lipomas, one chondroma, one leiomyoma, one neurinoma and one papilloma. The rest were 230 cancerous tumors. The 34 benign tumors constituted 13 per cent of all the tumors, which is slightly higher than the percentage (10 per cent) found in the literature.

Although it is usual to classify those tumors as benign by virtue of their histologic characteristics and the long course of the disease, it must be emphasized that because of their localization in the respiratory tract, they are dangerous and may cause the death of the patient through processes secondary to obstruction of the bronchi.

Material

A. Adenomas: Of the 18 patients with adenoma, there were 11 women and seven men, whose ages ranged from 23 to 65 years (average 38 years). The most frequent complaints were cough, usually productive, and sometimes hemoptysis, and also recurrent pneumonia. In only six patients was the tumor discovered on routine radiologic examination (Fig. 1) and also among them the above complaints appeared during the interval preceding the operation. The duration of the complaints was from three weeks to 17 years (average four years).

The radiologic findings were mostly of the secondary changes in the lungs: atelectasis and bronchiectasis. In six patients, only a round lesion could be seen (one of them obstructing the bronchus). Bronchial obstruction was recognized at bronchoscopy in ten of the patients. In eight it was clear that the obstruction was caused by endobronchial tumors. In one there was granulation tissue obstructing the lumen and in another one there was an undetermined constriction of the lumen of the bronchus. In two patients, treatment was limited to bronchoscopic removal of the tumor: one of them suffered for 16 years

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Figure 1: Round lesion found on routine x-ray examination in a woman aged 26 years: carcinoid adenoma in base of right lower lobe.
prior to referral from recurrent cough and hemoptysis and recently also from purulent sputum. During the eighth year of his illness, an adenoma of the right main bronchus was discovered by bronchoscopy and treated by cauterization in another hospital. He was well for the following eight years until several months before his admission here. Bronchoscopy again disclosed a mass in the right main bronchus. The proposed operation was postponed by the patient and when he returned a year later the tumor was already inoperable because of involvement of the trachea. Because of bleeding, the biopsy was inadequate for histologic diagnosis, but the diagnosis was considered adequately established by the long course and by typical clinical and endoscopic findings.

In the second patient, an obstructing nodule was excised bronchoscopically and was found to be an adenoma on histologic examination. General debility prevented radical resection, in spite of associated lobar atelectasis. In spite of the non-radical endoscopic treatment, the patient is well and alive to date.

The other diagnostic bronchoscopies did not prove conclusive because of insufficient material or misleading histologic diagnosis such as "carcinoma simplex" or "non-specific granulation tissue."

The operations of excision were done in accordance with the bronchi affected and included five pneumonectomies, one bilobectomy, six lobectomies and one local excision.

There was one death after pneumonectomy in an extremely obese woman 45 years of age who suffered for eight years from severe pyogenic complications (bronchiectasis and empyema, with repeated drainage) who went into postoperative shock and died 30 hours after operation.

The only other complication was pleural effusion which occurred in two of the lobectomy patients and which necessitated aspiration. In the remainder of the patients the postoperative course was completely normal.

The size of the tumors varied from 1.5 to 5 cm. and infiltration of the parenchyma was found in 13 of the 16 specimens (Fig. 2). Only in one case did the infiltration reach a lymph node in the hilus of the lobe. This patient was hospitalized one year later in another hospital for multiple metastases and a syndrome of hypersecretion of serotonin.

The histologic findings were typical carcinoid adenomas in 15 cases, one oncocytic, one adenoma and cylindroma in another.

Pathologic changes in the bronchi were present in most of the operative specimens. They varied from emphysema and slight dilatation of the bronchi in two cases to severe bronchiectasis, in most of the cases accompanied by severe abscesses and fibrosis. Only in two cases was the parenchyma near the tumor normal.

B. Hamartomas: There were ten hamartomas, four in men, six in women, of ages from 36 to 63 years (average 52 years). In six patients, the tumor was found on routine radiologic examination and the other four suffered from productive cough and recurrent pneumonia. Several of the tumors were known for many years. The duration of the illness was from two weeks to seven years (average two years and three months).
The radiologic findings were round lesion in eight cases. In one, there was a central lucency which simulated a cyst of the lung. The pathologic examination disclosed that the center of the hamartoma was necrotic (Fig. 3). In one patient, there was a shadow in the right base and tomography revealed obstruction of the intermediate bronchus. In another case there was atelectasis of the left lower lobe and bronchography demonstrated a filling defect of the left lower lobe bronchus.

The operations included one pneumonectomy, one bilobectomy, two segmentectomies, two enucleations and four wedge resections. Among these patients there were two deaths. One was a man of 58 years who had a pneumonectomy for an endobronchial hamartoma at the origin of the left lower lobe bronchus. The cause of death was hemorrhage from the pulmonary artery which was dilated and sclerotic, and ruptured proximally to its ligation a few minutes after the end of the operation. The second had a bilobectomy of the right lower and middle lobes for a hamartoma that had compressed the intermediate bronchus. The cause of death was a pulmonary embolism on the eighth postoperative day.

In the other patients, there was no postoperative complication.

**Macroscopic Findings**: in one patient there was an endobronchial polyp measuring 2.5 by 1.5 cm. which was attached by a narrow pedicle to the origin of the left lower lobe bronchus. The other nine tumors were localized within the parenchyma and measured 1-10 cm. (average 4.5 cm.). One of these had a central necrotic cavity.

**Microscopic Findings**: nine hamartomas consisted mainly of chondromatous tissue subdivided into small lobules by flat spaces and covered by a single layer epithelium. The tenth was constituted mainly of fatty tissue within which were found several glandular structures and nerve fibers—which conforms to the definition of a hamartoma containing mainly fatty tissue.

In both cases in which the hamartoma was excised together with the lung or lobes in which it had developed, there were widespread atelectases and fibroses found in the parenchyma; in one case there was

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*Figure 3: Cystic shadow in a woman aged 42 who suffered from pneumonia and chest pain. Histologically it was found to be hamartoma with central necrosis.*
cylindric bronchiectasis in the lower lobe.  

C. Lipomas: There were two cases of lipomas, both in men, one aged 53, the other, 45 years. Both suffered from cough, sputum and hemoptysis, the first for four years, the second for one and one-half years. Radiographically, in the first case there was opacification of the whole hemithorax with lucent patches in the upper field, and displacement of the mediastinum to the left. In the second case, there were elongated shadows in the right lower lobe and bronchography demonstrated bronchiectasis.

Bronchoscopy, which was performed only on the first patient, disclosed a smooth mass obstructing the lower lobe bronchus. Biopsy revealed no characteristic cells. This first patient had left pneumonectomy and the other one right lower lobectomy. The postoperative course was normal in both.

In the first case there was an elongated polyp attached by a narrow pedicle to a basal segmental bronchus. The polyp occupied most of the left lower lobe bronchus and obstructed it completely. In the second there was a small polyp measuring 8 mm. in diameter arising from the wall of the right lower lobe bronchus (Fig. 4). The histologic examination disclosed lipomas in both of them and there were widespread bronchiectasis in the excised parenchyma.

D. Chondroma: A woman aged 59 who suffered for ten months from cough, sputum and debility. Radiologic examination disclosed atelectasis of the left lower lobe, and by tomography, there was a peasized mass in the left main bronchus. Through the bronchoscope the mass was seen to have a smooth, light red surface; it was completely excised. Subsequently there was bleeding which caused atelectasis of the entire left lung. On second bronchoscopy, the clots were sucked out and the whole lung re-expanded. The excised mass measured 3 x 4 x 9 mm.

Histologic examination revealed that it consisted entirely of cartilaginous tissue covered by metaplastic inflammatory respiratory epithelium. Repeated examinations during six years did not reveal local recurrence and no further intervention was deemed necessary.

E. Leiomyoma: A man 53 years of age suffered for one year from cough, sputum, hemoptysis and recurrent pneumonia. Radiologic examination disclosed atelectasis of the right middle lobe and tomography revealed a mass in the right main bronchus. At bronchoscopy, a whitish, olive-sized mass was seen which concealed the lumen of the bronchus without obstructing it completely. The whole mass was removed through the bronchoscope. The middle lobe re-expanded completely after the bronchoscopy. Histologic examination disclosed that the tumor consisted of smooth muscle fibers.

F. Neurinoma: A boy aged 13 who suffered for one and one-half years from cough and sputum which was sometimes tinged with blood. On physical examination dullness to percussion and decreased breath sounds were found over the left

**Figure 4:** Endobronchial lipoma of the right lower lobe bronchus in a man aged 45.
lower lung. Radiologic examinations, including bronchography, demonstrated bronchiectasis of the left lower lobe. On bronchoscopy, which was performed at another hospital, the findings were suspicious of an endobronchial carcinoma. In our department a left lower lobectomy was performed. The postoperative course was normal. In the excised lobe a mass was found which encircled the basal segmental bronchus and displaced the parenchyma. The histologic examination revealed neurinoma. The remainder of the bronchi of the excised lobe were bronchiectatic.

G. Papilloma: A man of 48 years, presenting with cough, sputum and hemoptysis for a month's duration. Physical examination was normal. Radiologic examination disclosed an oval mass in the anterior segment of the right upper lobe. Bronchoscopy was negative. Right upper lobectomy was performed. The lobe was found shrunken and in the bronchus of its anterior segment there was a mass which on histologic examination was found to be a papilloma of the respiratory passages.

DISCUSSION

A. Adenomas: Adenomas are usually classified into carcinoid types and cylindromas.\textsuperscript{4,4} Among the carcinoid type adenomas, the onchocytic variety (Stout\textsuperscript{4}) is found very rarely. These types differ both histologically and in their clinical behavior. The cylindromas tend more to metastasize (up to 30 per cent) than the carcinoids (up to 10 per cent) (McBurney \textit{et al.\textsuperscript{5}}). The natural course of the adenomas of all types is usually very long. The patients suffer from recurrent respiratory infections, hemoptysis, and evolve the usual complications of bronchial obstruction: bronchiectasis and empyema. In many of the cases the adenomas exhibit characteristics that are accepted as criteria of malignancy: infiltrative invasion of the peripheral parenchyma, metastases in regional lymph nodes and even distant metastases,\textsuperscript{5,4,10} but the course of the disease is always very long and cases of death as a result of metastases are almost unknown.\textsuperscript{4,4} Nevertheless, the life of the patient is in danger as a result of suppurative changes secondary to the bronchial obstruction. From this point of view the adenomas resemble all other benign tumors which endanger the life of the patient as a result of their localization in a vital organ, and not because of malignant characteristics that are inherent in the nature of the tumor tissue itself.

The carcinoid adenomas are so named because of their morphologic resemblance to tumors of the same name that are found in the gastrointestinal tract, mostly in the appendix. In recent years it was found that the resemblance is not only morphologic, but that carcinoid adenomas of the bronchus also may secrete serotonin.\textsuperscript{7} The secretion is rare in bronchial carcinoids, but Williams and Azzopardi\textsuperscript{8} demonstrated histo-chemically that the substance was present in adenomas from patients in whom there were no clinical symptoms of excretion. The serotonin syndrome was found also in one of our patients, though only one year postoperatively when she was hospitalized in another hospital.

The therapeutic approach of endoscopic excision which was accepted up to about two decades ago,\textsuperscript{9} has been discarded and the treatment of choice now is excision of the lobe or lung involved. The justification of this radical approach is the infiltrative quality of these tumors and also the great frequency of bronchiectases distal to the adenoma. Although several authors\textsuperscript{9,11} have proposed and performed bronchotomy and sleeve resection, it seems that in view of the above considerations this treatment is not adequate.

Only in one case in which the adenoma was small and peripheral to a segmental bronchus was enucleation performed and the parenchyma of the lung conserved. The endoscopic treatment remains as a palliative measure for the few cases who are in such bad general condition that thoracotomy is excluded. It is aimed to prevent as far as possible bronchiectasis and peripheral infection in these patients.
B. Hamartomas: The term hamartoma designates an unorganized mass of cells and tissue which are derived from the parent organ. The origin of this term is in the description by Albrecht of hamartoma of the liver. Hamartomas are also found in most other tissues, but mostly in the kidneys and the lungs. Most of the hamartomas of the lungs consist mainly of cartilaginous and myxomatous tissue divided into lobules which are covered by a cubic or cylindric epithelium, which is often ciliated. This tissue occasionally includes foci of ossification and areas of fatty tissue or smooth muscle and nerve cells. Occasionally, fatty tissue is so predominant that the differentiation from lipomas is only made by the finding of all or some of the above tissues scattered within the fat tissue.

Some authors (Graham and Womack) include the adenomas with the hamartomas under the term “mixed tumors of the lung,” and see in the adenoma a form in which the epithelial component is dominant, whereas in the hamartoma it is the mesenchymal component. This classification has not been accepted by recent authors.

The hamartomas are usually benign tumors, but a few cases of malignant metaplasia within them have been reported. Their growth is very slow and can be measured only on radiographs that have been done several years apart. They appear as round masses and it is usually impossible to differentiate them from other round lesions, except if the calcified granulation can be seen in the mass. Their localization is usually peripheral and therefore it is rare for them to cause damage to the lung parenchyma by obstruction of bronchi. According to this localization, they can usually be extirpated by enucleation or wedge resection, and only rarely is it necessary to perform lobectomy or pneumonectomy. The indication for operation is the impossibility of differentiation from malignant tumors and the possibility of the development of disturbance (atelectasis, hemoptysis) during the years after the discovery of the tumor.

C. Lipomas: The lipomas are very rare and differ from the hamartomas in that they lack any component other than the fat tissue of which they consist. Their origin is from fat tissue which is normally found in the bronchial wall.

Because of their localization in the larger bronchi, they usually cause bronchiectasis, as happened in both of our patients, and as in most of the cases described elsewhere. For this reason it is usually indicated to excise them together with the distally involved lung parenchyma.

D. Chondromas: True chondromas are tumors composed purely of cartilage and are very rare within the lung. There has been an appreciable number of cases published under this heading in the past, which really were hamartomas and which consisted mainly of cartilage. Only in recent years has it become accepted to use this diagnosis for purely cartilaginous tumors only. Dongels and associates have lately described a case resembling ours, but with a different localization of the tumor which was removed by bronchotomy, since the distal lung was not damaged. In our case, the tumor could be excised completely through the bronchoscope and no excision of parenchyma was necessary since the distal lung was found to be and remained, normal.

E. Leiomyomas: In 1957 Crastnopol and Franklin collected 12 cases from the literature and added one of their own. These tumors were usually localized peripherally and only a few were found in the larger bronchi. In our case the tumor was localized in the right main bronchus and was excised through the bronchoscope. The atelectatic changes seen distally before the excision cleared after it, which made further excision of lung tissue unnecessary.

F. Neurinomas: The neurinomas are neurogenic tumors which appear singly in contrast to the neurofibromata of Von Recklinghausen's disease, which appear in large numbers in one patient and which
also differ from them histologically. The neurogenic tumors are relatively frequent in the mediastinum, but very rare in the lungs. Usually the tumor is localized within the peripheral parenchyma without any protrusion into the bronchial lumen. In our case, the tumor was found unexpectedly within a left lower lobe resected from a boy 13 years of age for bronchiectasis.

G. Papilloma of the bronchi: Salek et al. described two cases in 1958. They note that these are polypoid formations in the mucosa of the bronchi which resemble morphologically the inflammatory polyps of the upper respiratory tract, in which they are found much more frequently than in the bronchi. It is not clear if their etiology is neoplastic or inflammatory. The above authors tend to accept the inflammatory theory. In our case the papilloma was a mass in a segmental bronchus of the right upper lobe, which caused fibroses of the distal lung. Lobectomy had to be performed.

**SUMMARY AND CONCLUSIONS**

Thirty-four cases of benign tumor of the lung and bronchi have been presented. These represent the case material of the department of Thoracic Surgery in the years 1950-1960 and comprise 13 per cent of the lung tumors that were operated during the same years. Eighteen were adenomas, ten hamartomas, two lipomas, one chondroma, one leiomyoma, one neurinoma and one papilloma.

From the therapeutic point of view, adenomas have to be considered apart from the rest of these tumors. The adenomas possess potentially malignant qualities (local invasion and sometimes even metastasis) in addition to the danger of bronchial obstruction and secondary infection. This justifies the radical approach, and their excision together with the parenchyma distal to the involved bronchus. The surgical approach is justified for the rest of those tumors too, both because of the danger of bronchial obstruction and the impossibility of their differentiation from the malignant tumors without thoracotomy. Only in a few cases is bronchoscopic treatment indicated: when the tumor is endobronchial and on a narrow pedicle, or as palliative treatment when the patient's condition excludes thoracotomy.

**RESUMEN**

Se presentan 34 casos de tumores benignos del pulmón y de los bronquios. Son el material del departamento quirúrgico de 1950 a 1960 y comprenden el 13 por ciento de los tumores pulmonares operados durante esos años. Diez y ocho fueron adenomas, 10 hamartomas, 2 lipomas, 1 condroma, 1 leiomioma, 1 neurinoma y 1 papiloma.

Desde el punto de vista terapéutico los adenomas tienen que considerarse aparte de los otros tumores. Los adenomas poseen cualidades de potencial maligno (invasión local y a veces aun metástasis), además del peligro de la obstrucción bronquial y de infección secundaria. Esto justificó la actitud radical, su excisión junto con el parénquima distal del bronquio comprometido. La terapéutica quirúrgica se justifica en los otros tumores también, tanto por el peligro de la obstrucción como por la imposibilidad de diferenciación de los tumores malignos sin la toracotomía. Sólo pocos casos tienen como indicación la broncoscopia terapéutica: cuando el tumor es endobronquial con pedículo angosto o como paliación cuando las condiciones del enfermo excluyen la toracotomía.

**RESUMÉ**

L'auteur rapporte trente quatre cas de tumeurs bénignes du poumon et des bronches. Ceci représente le matériel du service de chirurgie thoracique pour les années 1950-60 et ces cas comprennent 13% de tumeurs pulmonaires opérées pendant les mêmes années. Il y eut dix-huit adénomes, dix hamartomes, deux lipomes, un chondrome, un leiomyome, un neurinome et un papillome.

Du point de vue thérapeutique, les adénomes doivent être considérés à part du reste de ces tumeurs. Les adénomes possèdent des caractères de malignité en puissance (invasion locale et quelquefois même métastases) en plus du danger d'obstruction bronchique et d'infection secondaire. Cela justifie une tentative de traitement radical, leur exérèse doit comprendre aussi celle du parenchyme situé au-delà de la bronche atteinte. La tentative chirurgicale est également justifiée pour les autres tumeurs, à la fois à cause du danger d'obstruction bronchique et de l'impossibilité de leur différenciation des tumeurs malignes sans thoracotomie. Dans quelques cas seulement, le traitement bronchoscopique est in-
diuqué: lorsque la tumeur est endobronchique, et sur un pédicule étroit, ou comme traitement palliatif lorsque l'état du malade exclut la thoracotomie.

Zusammenfassung
Es wird über 34 Fälle gutartiger Lungen- und Bronchustumoren berichtet. Es handelt sich dabei um 13% der während der Jahre 1950-1960 in der thoraxchirurgischen Abteilung operierten Lungentumoren. 18 waren Adenome, 10 Hamartome, 2 Lipome, bei jeweils 1 Fall handelte es sich um ein Chondrom, ein Leiomyom, ein Neurinom und ein Papillom.


References

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