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Tumorlike Lesions of the Lung and Pleura

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INFLAMMATORY PSEUDOTUMOR

The inflammatory pseudotumor is a nonneoplastic pulmonary lesion composed of a variety of inflammatory and mesenchymal cells, including plasma cells, histiocytes, mast cells, lymphocytes, and spindle-shaped mesenchymal cells. The entity has been reported under a confusing variety of names, such as plasma cell granuloma, pseudotumor, postinflammatory pseudotumor, postinflammatory tumor, histiocytoma, xanthoma, xanthomatous tumor, solitary mast cell tumor, solitary mast cell granuloma, pseudoneoplastic pneumonitis, plasmacytoma, inflammatory myofibroblastic tumor, and inflammatory myofibrohistiocytic proliferation simulating sarcoma.[1]

Pseudotumor is a confusing term; many pathologists are uncertain about whether this lesion is neoplastic because rare examples have recurred or invaded hilar structures, mediastinum, and pleura. A tumor is a space-occupying lesion and not necessarily a neoplasm. This lesion is an inflammatory tumor, but we prefer the name inflammatory pseudotumor because it is more widely used.[1]

In 1954, Umikar and Iverson first used the name "inflammatory pseudotumor" for a sharply circumscribed, unusual tumorlike lesion of the lung.[2] In 1973, Bahadori and Liebow reviewed the literature and reported 40 cases.[3] They chose the term "plasma cell granuloma," because they though it best described the histology.[3] Spencer reported 27 cases under the term "plasma cell-histiocytoma complex" in 1984,[4] and Matsubara and colleagues reviewed the clinical and pathologic features of 32 cases in 1988.[5]

The lung is the major site in which these uncommon lesions have been found. They also occur in the trachea, heart, stomach, liver, pancreas, spleen, lymph node, kidney, retroperitoneum, mesentery, pelvic soft tissue, spinal cord meninges, cranial meninges, thyroid gland, orbit, skin, and other sites.[6–21] Inflammatory pseudotumors in extrapulmonary sites are of great interest but have not led to a better understanding of the pathogenesis of the lesion.

The true incidence of inflammatory pseudotumor in the lung is unknown. Golbert and Pletnev reported an incidence of 0.7% among the 1075 lung and tracheal tumors examined at the P.A. Herzen's Moscow Oncological Institute.[22] Hartman and Shochat reported that these lesions accounted for 45 (57%) of 79 benign lung tumors in childhood.[23]

Inflammatory pseudotumors occur in male and female patients and in all age groups. Table 61-1 summarizes the clinical and pathologic features found in several large series. The data of some researchers were based on pathologic examinations, and the data of others were based on reviews of clinical reports.[3–5,24–27] The patients were between 1 and 77 years of age at diagnosis, with series means from 8 to 50 years. Between 26% and 56% of the patients in the various series had cough, hemoptysis, shortness of breath, chest pain, and other symptoms; the remainder were asymptomatic. Chest x-ray films usually revealed a solitary, circumscribed, round or oval tumor mass, although in some instances, the edges of the mass were ill-defined, particularly those of larger lesions. Calcification and cavitation were also reported. The lesion can occur in any lobe of the lung.

Pathology

GROSS APPEARANCE

The lesions are 0.5 to 36 cm in diameter and usually have well-defined margins and capsules (Fig. 61-1). The color and texture depend on their main constituent cell types. Lesions composed predominantly of lymphocytes and plasma cells are tan and rubbery, those with more mesenchymal spindle cells are gray and firm, and those with abundant fat-filled macrophages are bright

TABLE 61-1
Clinical and Pathologic Features of Inflammatory Pseudotumors

Feature	Bahadori and Leibow[3] (1973)	Monzon et al[25] (1982)	Berardi et al[26] (1983)	Spencer[4] (1984)	Matsubara et al[5] (1987)	Shirakawa et al[27] (1989)	Pettinato et al[24] (1990)
Number of patients	40	44	181	27	32	48	19*
Mean age (y)	29	8	29	36	50	41	27
Age range (y)	1–68	1–15	1–73	4–76	2–77	5–71	2–72
Male/female patients	15/25	24/20	77/76	16/11	14/15	32/16	9/10
Symptoms (%)	40	56	26	56	40	49	60
Previous respiratory infection (%)	5	ND	30	37	25	7	21
Right/left lung	21/18	24/17	93/59	13/12	9/18	27/24	1/19
Size (cm)	0.8–1.2	1–12†	0.5–6	ND	1–15	ND	1.2–15
Follow-up results							
Well (%)	90	ND	87		100	ND	91
Recurrence (%)	5	ND	5		7	ND	9

** Original reports described 20 cases, but one was of esophageal origin.*
† Radiologic size.
ND, not described.

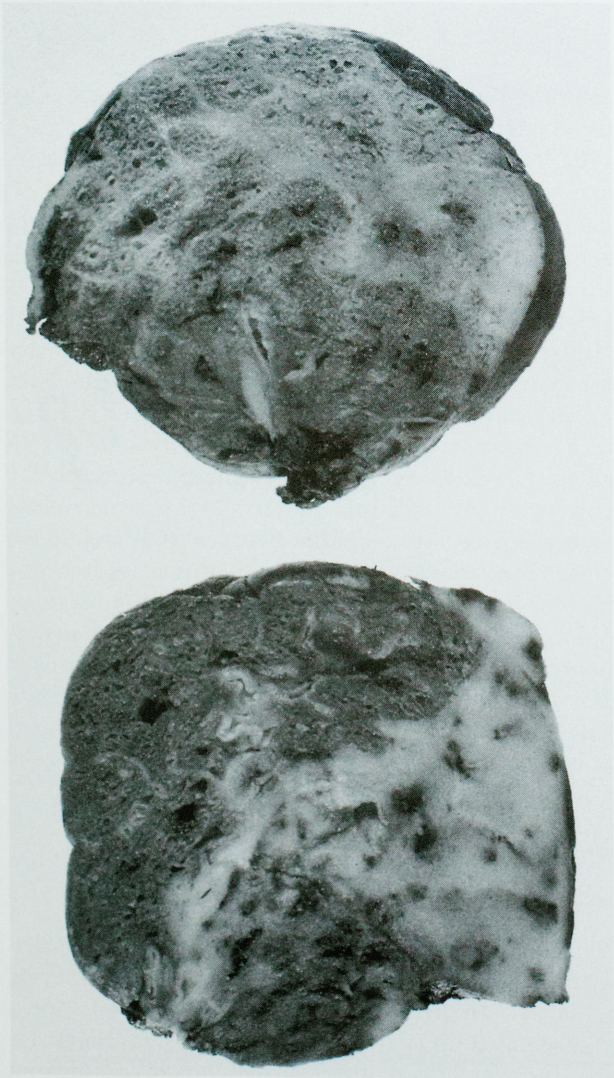

FIGURE 61-1. The cut sections of an inflammatory pseudotumor reveal an irregularly shaped, firm, gray-tan mass with well-defined margins.

yellow and soft. The masses are almost always solid, but a few have grossly apparent areas of hemorrhage, central necrosis, or calcification. Occasionally, they grow out as sessile polyps, obstructing a large bronchus, or may extend through the pleura or along bronchi into the mediastinum.[3,28]

LIGHT MICROSCOPIC APPEARANCE

The inflammatory pseudotumor is a discrete lesion in which the fine architecture of the pulmonary parenchyma has been destroyed and replaced to some extent by inflammatory cells and fibroblastic stroma. The histologic appearance depends on the relative numbers of plasma cells, lymphocytes, mononuclear and multinuclear histiocytes, and foamy macrophages in the lesion. Smaller numbers of neutrophils, eosinophils, and mast cells may also be present.

Depending on the dominant cellular constituent and the major histopathologic feature, inflammatory pseudotumors are classified as organizing, fibrous histiocytoma, or lymphoplasmacytic.[5] These three types represent different stages in the evolution and progression of the inflammatory pseudotumor.

The organizing pneumonia type is characterized by intraalveolar lymphohistiocytic inflammation and fibrosis at the periphery of the tumor (Figs. 61-2 and 61-3) and by a fibrous scar toward the center (Fig. 61-4). Fibroblasts proliferate into fibrinous exudate and inflammatory cells in alveoli, alveolar ducts, and bronchioles (Fig. 61-5). There is a good preservation of alveolar architecture with intraalveolar whorls of fibrous tissue (Fig. 61-6). The intact alveolar walls are most noticeable at the periphery of the tumor. Neutrophils, sometimes admixed with lymphocytes and plasma cells, form microabscesses in the center and at the periphery of the tumor. Destruction of tissue by abscess formation produces small cavitations. The alveoli surrounding the tumor are filled with foamy macrophages and lined by hyperplastic pneumocytes. Multinucleated giant cells of the Touton type are sometimes seen. Foci of dystrophic calcification, small areas of osteoid metaplasia, and myxomatous change are occasionally observed.

FIGURE 61-2. In an organizing pneumonia type of inflammatory pseudotumor, intraalveolar lymphohistiocytic infiltration and fibrosis are seen at the edge of the tumor. (H & E stain; low magnification.)

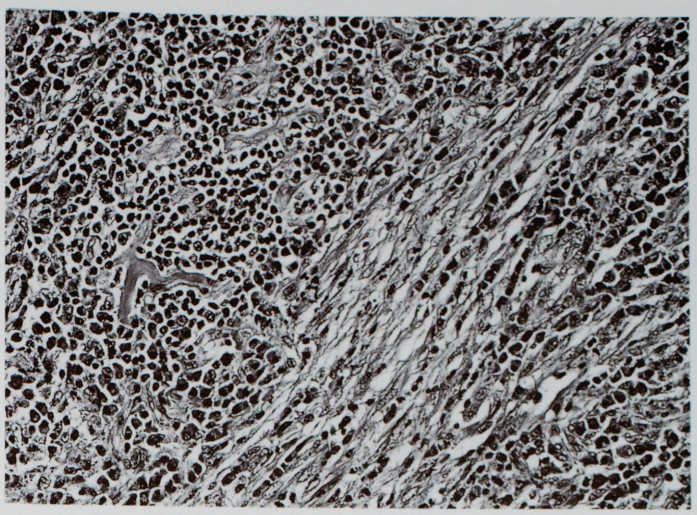

FIGURE 61-3. A high-power view of the specimen in Figure 61-2 shows a spindle cell proliferation admixed with lymphocytes and plasma cells. (H & E stain; low magnification.)

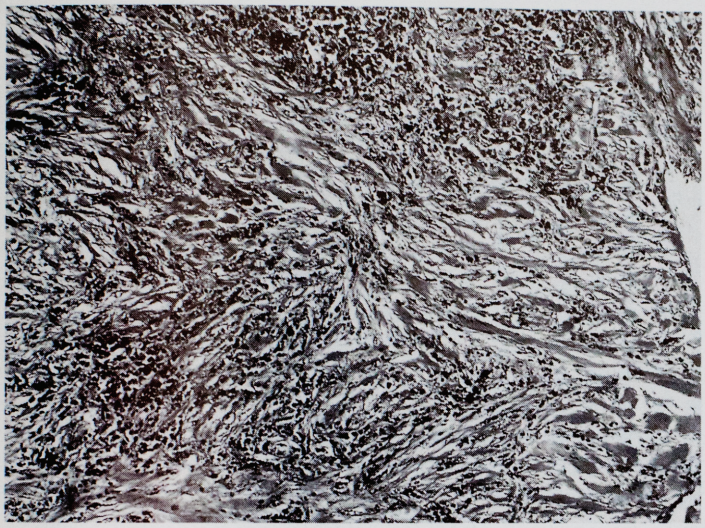

FIGURE 61-4. In this organizing pneumonia type of inflammatory pseudotumor, a fibrous scar is seen in the center of the tumor with sparse lymphoid cell infiltrations. (H & E stain; low magnification.)

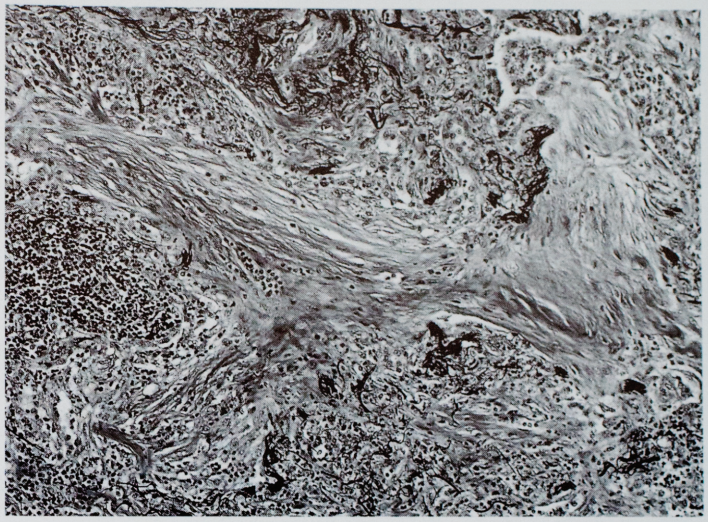

FIGURE 61-5. In this organizing pneumonia type of inflammatory pseudotumor, a branching tuft of fibrous tissue is seen in the bronchiole and the alveolar ducts. (Elastic tissue stain; low magnification.)

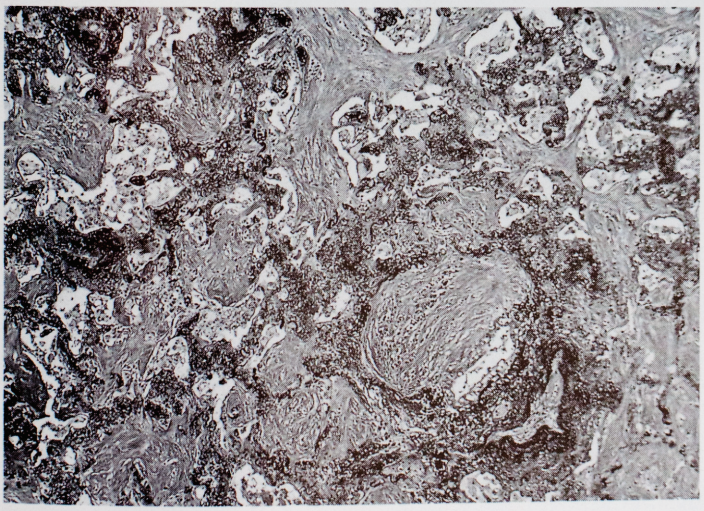

FIGURE 61-6. In an organizing pneumonia type of inflammatory pseudotumor, a long-standing, poorly cellular fibrosis is seen in the intra-alveolar lumens, and the alveolar architecture is well preserved. (Elastic tissue stain; low magnification.)

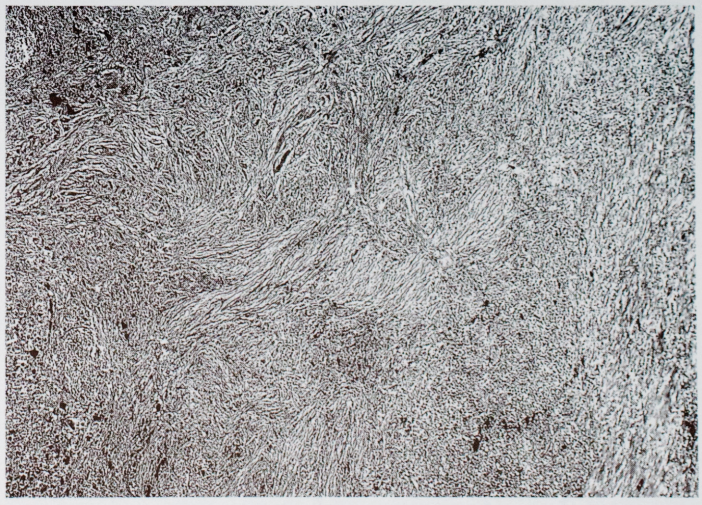

FIGURE 61-7. In a fibrous histiocytoma type of inflammatory pseudotumor, spindle-shaped cells are arranged in interlacing fascicles with a storiform pattern. (H & E stain; low magnification.)

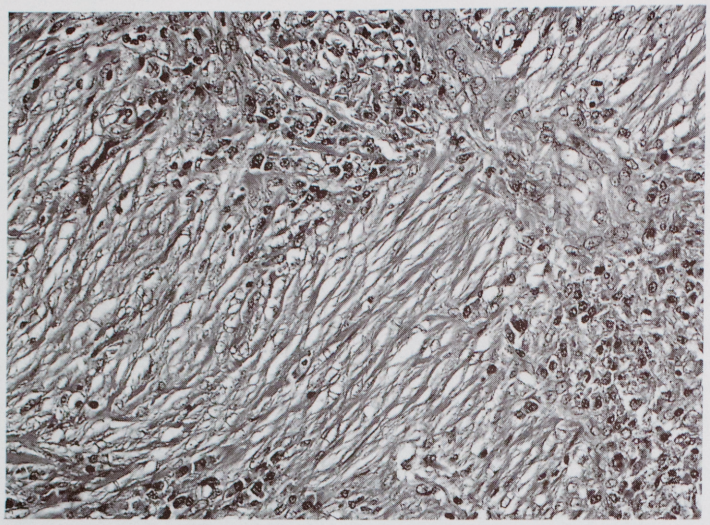

FIGURE 61-8. A closer view of the specimen in Figure 61-7 shows spindle cell proliferation, lymphocytes, and plasma cells. (H & E stain; intermediate magnification.)

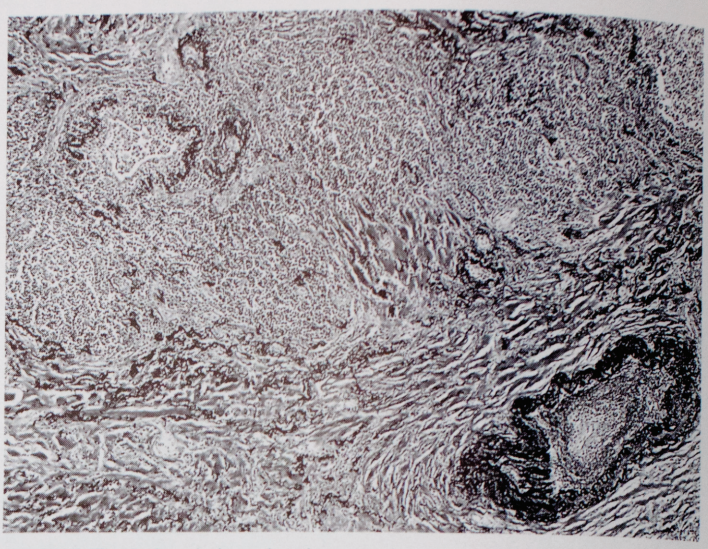

FIGURE 61-9. A lymphoplasmacytic type of inflammatory pseudotumor contains lymphoid aggregates and germinal centers. Fibrous obliteration of blood vessels is also apparent. (Elastic tissue stain; low magnification.)

Purulent or granulomatous bronchopneumonia suggestive of active infectious pneumonia are not seen. In the center of the tumor, the alveolar architecture is generally effaced, and collagen forms broad bundles with hyalinization.

The fibrous histiocytoma type is characterized by the proliferation of mesenchymal spindle cells arranged in whorls, interlacing fascicles, and storiform patterns (Figs. 61-7 and 61-8). The nuclei of these spindle cells are normochromatic or slightly hyperchromatic. Mitoses are rare or absent. The amount of collagen varies, sometimes forming discrete scars.

In the lymphoplasmacytic type, plasma cells and lymphocytes comprise much of the tumor. Lymphoid aggregates become confluent, and large germinal centers are seen (Figs. 61-9 and 61-10). Spindle-shaped fibroblasts and xanthoma cells are inconspicuous. Lymphocytes, plasma cells, histiocytes, and collections of neutrophils infiltrate into and around bronchioles and alveoli at the edges of the lesion (Fig. 61-11).

The three histologic types usually overlap and no one type is free of the features present in the other two types; none of the types are composed of solid sheets of lymphocytes or plasma cells. Within the tumor, bronchi and bronchioles are sometimes invaded by inflammatory and fibrous tissue (Fig. 61-12); about 10% of these lesions have spread to endobronchial sites (Fig. 61-13). Vascular inflammation (Fig. 61-14) was observed in six of eight cases by Water and associates, but Matsubara and colleagues found lymphocytic infiltration and scarring of the vascular walls in only one half the cases, and it was sometimes associated with thrombosis and organization.[5,29] The vascular changes are clearly secondary and do not represent a primary vasculitis or neoplastic infiltration.

ELECTRON MICROSCOPIC APPEARANCE

Electron microscopy shows a polymorphous cellular population composed of fibroblasts, myofibroblasts, pericytes, endothelial cells, lymphocytes, plasma cells, histiocytes, and primitive

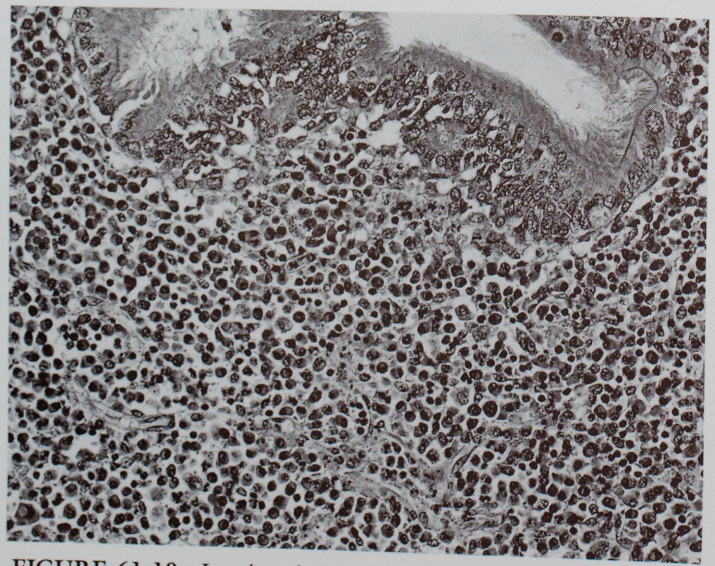

FIGURE 61-10. In a lymphoplasmacytic type of inflammatory pseudotumor, there are numerous plasma cells and lymphocytes around a bronchus. (H & E stain; intermediate magnification.)

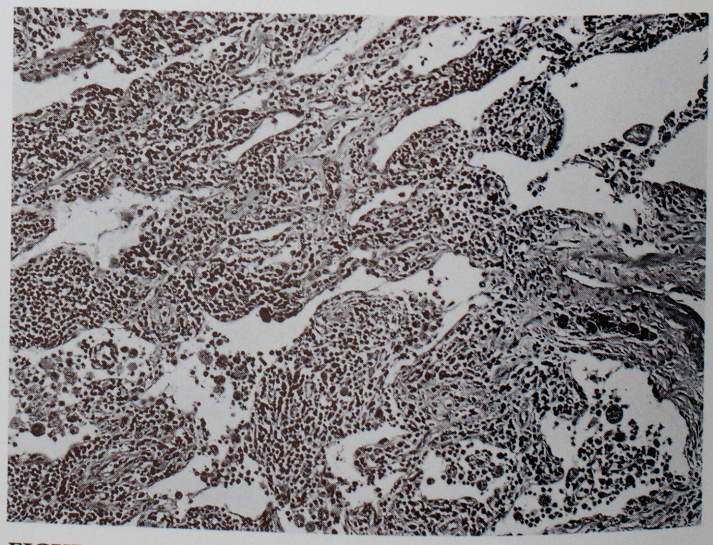

FIGURE 61-11. In a lymphoplasmacytic type of inflammatory pseudotumor, lymphoid cells infiltrate in and around the bronchioles and alveoli at the edge of the tumor, resembling lymphoid interstitial pneumonia. (H & E stain; low magnification.)

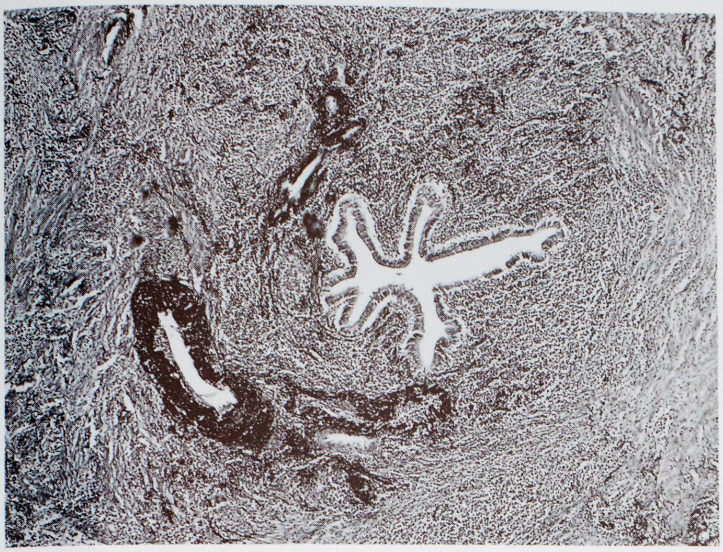

FIGURE 61-12. A bronchiole and blood vessels are invaded by inflammatory and fibrous tissue within this inflammatory pseudotumor. (Elastic tissue stain; low magnification.)

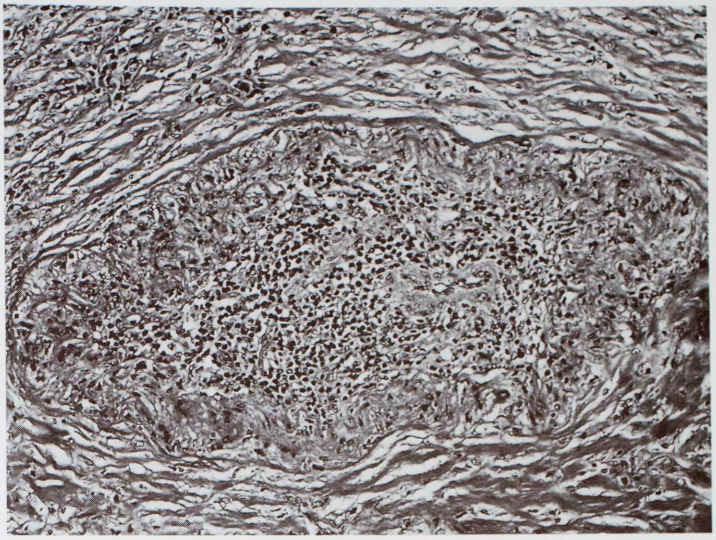

FIGURE 61-14. An inflammatory pseudotumor shows lymphocytic infiltration, fibrous scarring, and obliteration of the lumen of a blood vessel. (H & E stain; low magnification.)

mesenchymal cells.[24,30–32] No virus particles or other specific structures suggesting persistent organisms have been identified.

IMMUNOHISTOCHEMISTRY

Immunohistochemical studies reveal vimentin and sometimes desmin and actin positivity of the spindle-shaped mesenchymal cells.[12,24] The plasma cells exhibit immunoreactive κ and λ light chains, indicating polyclonal proliferation.[24,25,29]

Etiology

The exact cause of inflammatory pseudotumor is unknown. The lesion is considered to be nonneoplastic, reactive, and inflammatory because of its intraalveolar organization, history of a previous respiratory infection, and the polymorphous nature of the cellular infiltrate. Previous respiratory infection was documented in 5% to 37% of the patients (see Table 61-1). Some case reports have suggested an overlap in the appearances of inflammatory pseudotumor and the infectious lesions of *Aspergillus*, Q fever, virus, mycobacteria, or other bacteria.[33–36]

Other investigators think that these lesions are neoplastic, and in a few cases, aggressive tumors have been reported. Warter and associates emphasized the endovascular spread seen in some patients, and in one of their patients, death resulted from extension into the pulmonary veins.[29] Extension to the mediastinum or thoracic wall has been reported.[3,28] In addition to these uncommon manners of spread, the potential for recurrence and the histologic resemblance of inflammatory pseudotumor to fibrous histiocytoma of soft tissues suggest that some lesions may be neoplastic.

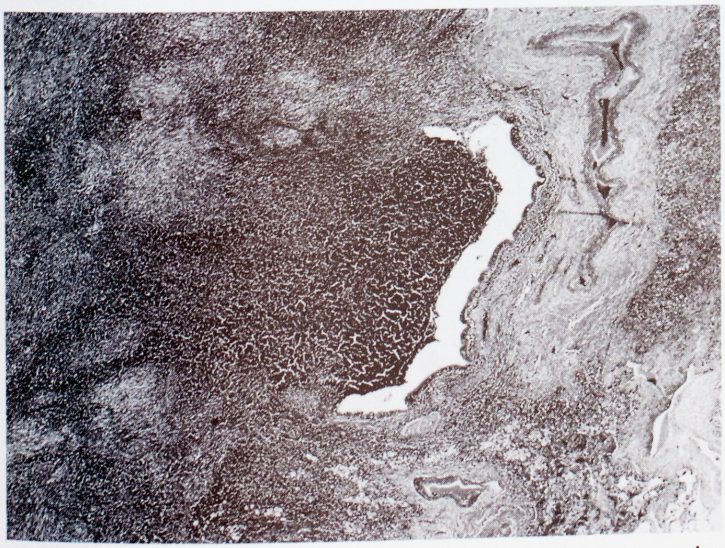

FIGURE 61-13. Endobronchial growth of an inflammatory pseudotumor. (H & E stain; low magnification.)

Differential Diagnosis

The differential diagnosis of the inflammatory pseudotumor depends on its histologic appearance. The lymphoplasmacytic type closely resembles pulmonary plasmacytoma, lymphoma, and pseudolymphoma (*i.e.*, localized lymphoid interstitial pneumonia). Pulmonary plasmacytoma is a circumscribed mass of neoplastic plasma cells with a monoclonal production of globulin.[37] Lymphomas of the lung consist of neoplastic lymphoid cells that generally are monomorphic and monoclonal.[38,39] Occasional giant cells and a polymorphous inflammatory cell infiltrate may suggest Hodgkin disease.[40] Pseudolymphomas are composed predominantly of mature lymphocytes, which are not the predominant cells in inflammatory pseudotumors (see Chap 55.).[38] The fibrous histiocytoma type resembles primary pulmonary and metastatic malignant fibrous histiocytoma, benign mesenchymal tumors, and sclerosing hemangioma. The absence of marked cellular atypia, necrosis, and abnormal mitotic figures separates it from malignant fibrous histiocytoma.[41,42] The endobronchial growth of inflammatory pseudotumor leads to symptoms of cough and hemoptysis, and the lesion must be differentiated from benign mesenchymal neoplasms of the tracheobronchial tree.[43] However, benign mesenchymal tumors such as fibromas or neurinomas are uncommon in the lung and do not contain an admixture of inflammatory cells.[43,44]

Sclerosing hemangioma was once considered synonymous

with inflammatory pseudotumor, but it is now considered a distinct disease entity.[45] Sclerosing hemangioma may produce focal sclerosis, but it has numerous prominent blood vessels, striking epithelial proliferation, and large numbers of uniform mononuclear cells of uncertain histogenesis. Inflammation in sclerosing hemangioma is scant (see Chap. 58).

Treatment and Prognosis

The lesions that have been observed for extended periods before their surgical removal or examination at autopsy remained stable or increased slowly. Follow-up data confirm the good health of most patients, but the tumor may recur in 5% to 9% of patients, as shown in Table 61-1. Surgical removal is usually necessary to establish a correct diagnosis, and if the lesion is completely removed, no additional diagnostic studies or therapy are indicated.

If the lesion has extended into the neighboring structures or has not been removed completely, it may persist and continue to enlarge. If it extends to the pleura or produces fibrous adhesions to the diaphragm or mediastinum, the lesion is unresectable. In general, the prognosis is excellent, but deaths resulting from a very large lesion and from a tumor involving the mediastinum have been reported.

ROUNDED ATELECTASIS

Round or rounded atelectasis is a special form of peripheral partial atelectasis of a lobe (Fig. 61-15). Radiographically, this lesion presents with a subpleural, round mass, usually at the periphery of the lung and in the lower lung zone. This disease has been called folded lung syndrome, round atelectasis, atelectatic pseudotumor, pleuroma, Blesovsky syndrome, helical atelectasis, pulmonary pseudotumor, and shrinking pleuritis with atelectasis; the last term portrays the histogenesis of the lesion.[46–53] In 1928, Loeschke first mentioned this pathologic condition as an "occurrence of upward tilting of small or larger pieces of the lower lung margins . . . followed by the development of atelectasis."[54] In 1956, Schuemmelfeder confirmed these findings and stated that the enfolding of the lung can occur in a upright and backward fashion and in a downward and diaphragmatic direction.[55] Roche and colleagues published radiographs and diagrams of this condition.[56] Heine reported several cases of masslike atelectasis that developed in patients after therapeutic pneumothoraces. He resected and successfully reinflated these lesions after decortication.[57] Blesovsky described this pathologic condition as a new disease entity or "folding lung."[46] It is Hanke's report that most clearly described the atelectatic basis of this condition.[47]

The exact incidence of rounded atelectasis is unknown. After an evaluation of 96 samples of exudative pleuritis, Hanke reported the finding of marginal tilting of the residual lesion in 59 (62%) and tumorlike rounded atelectasis in 22 (23%).[47] Nevertheless, this lesion is uncommonly diagnosed clinically or pathologically.

Many patients with round atelectasis have no symptoms of pleural or pulmonary disease. The signs and symptoms are mainly related to the underlying pleural effusion, including cough, dyspnea, dullness in response to percussion, and increased sedimentation rate.

Diagnosis of rounded atelectasis is based on the characteristic radiographic appearance and the exclusion of a malignant tumor. Radiographically, the lung density is rounded and subpleural, most often in the dorsal or laterobasal area of a lower lobe (Fig. 61-16). This is frequently accompanied by a cone-shaped density, also described as a comet-tail, which represents compressed vessels and bronchi entering the atelectatic zone and forming an arc. There is a wedge-shaped shadow of restrictive atelectasis extending from a margin of the round lesion; an air bronchogram may be seen. There may be hyperlucency of neighboring parenchyma or

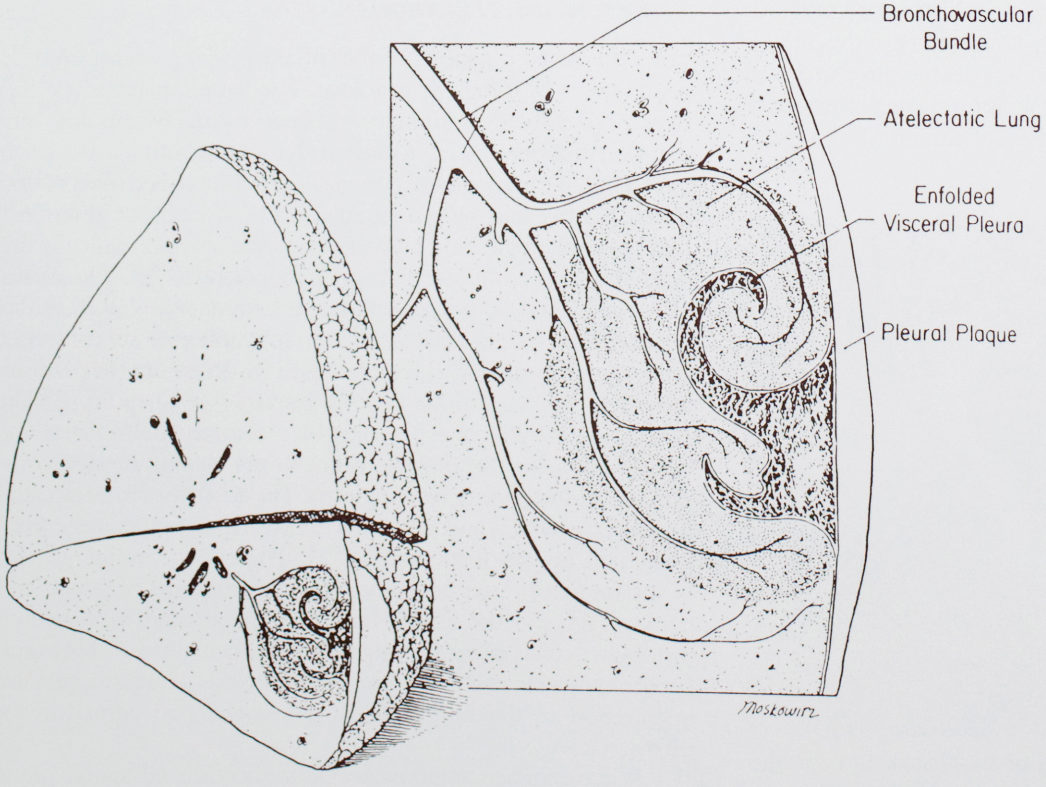

FIGURE 61-15. Representation of a rounded area of atelectasis beneath a pleural plaque. (From Case Records of the Massachusetts General Hospital, Case 24-1983. N Engl J Med 1983; 308:1466.)

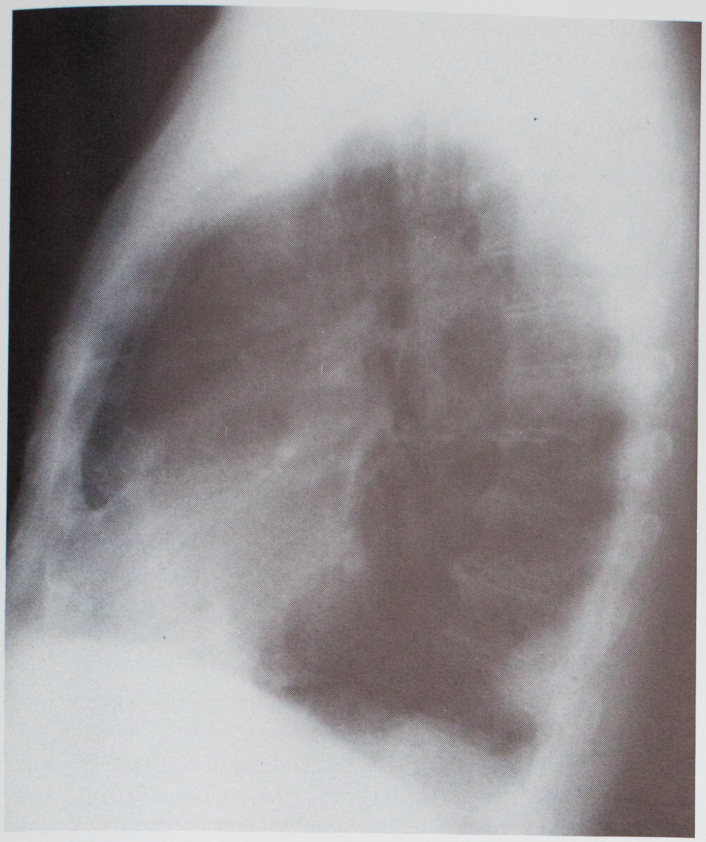

FIGURE 61-16. A lateral radiograph of the chest of the patient represented in Figure 61-15 reveals a round, well-defined mass abutting the pleural surface in the left lower lobe. (From Case Records of the Massachusetts General Hospital, Case 24-1983. N Engl J Med 1983;308:1466.)

FIGURE 61-17. A coronal section of the lung was made beneath the pleural plaque after inflation and fixation with formalin. The pleura is indented at two points. The adjacent atelectatic lung is retracted toward the plaque. (From Case Records of the Massachusetts General Hospital, Case 24-1983. N Engl J Med 1983;308:1466.)

reduction in size of the lobe. The pleura adjacent to the lesion is markedly thickened, and the pleural thickening extends over additional areas.

Pathogenesis

One explanation for this condition is that an initial pleural effusion may float the lower lobe of the lung upward, compressing it like a fingerlike projection, after which the atelectatic lung parenchyma adheres to the parietal pleura.[47,58] As the pleural fluid recedes, the central part of the collapsed lung reinflates, and the peripheral part remains atelectatic and rolls into a ball-like mass. Another explanation is that pleural fibrosis develops first and tethers the lung together as it matures and contracts, compressing contiguous lung parenchyma.[59,60] The second explanation is probably correct, because pleural effusions are uncommonly seen when rounded atelectasis is diagnosed. Asbestos and tuberculosis are the common causes of the pleural fibrosis (see Chap. 36).[46,61,62]

Pathology

The typical lesion of rounded atelectasis consists of a subplural, round mass that is 4 to 7 cm in diameter. Contiguous fibrous thickening of the visceral pleura occurs (Fig. 61-17). Histologically, the visceral pleura dips redundantly into the lung. The folded pleura contains lymphatics, blood vessels, and elastic fibers. An elastic tissue stain aids the diagnosis. The bronchi and blood vessels supplying the area of collapse are retracted toward the lesion and pulled close together. Mark mentioned that the fat beneath the visceral pleura in the most severely atelectatic tissue indicates atrophy of lung tissue and attests to the chronicity of the atelectasis.[60] Transthoracic needle biopsy specimens may show hyaline tissue, leading to the false diagnosis of hyalinosis of the pleura.

Treatment and Prognosis

After it is radiographically visible, the rounded atelectasis usually does not progress in size or contour over many years. Treatment is not indicated unless the lesion is unusually large. The real nature of the lesion is frequently unclear, and open lung biopsy with excision of the lesion is an acceptable alternative at thoracotomy. However, incision of the fibrous scar or decortication with uncoiling of the round atelectasis could restore ventilation to the affected area. Appreciation of the absence of a subpleural neoplasm before or during surgery can spare the patient an unnecessary lobectomy.

MISCELLANEOUS LESIONS

Tumorlike lesions of irregular outline or approximately spherical in shape, measuring 3 cm or less in diameter if they are nodules or more than 3 cm in diameter if they are masses, frequently occur in

the lung and are briefly mentioned in this section for the sake of completion.

Rheumatoid Nodules

Pulmonary nodules can develop in the lungs of patients with theumatoid arthritis. These lung nodules can be associated with skin nodules, and the patient's rheumatoid factor level is invariably high. Diffuse interstitial fibrosis and pleural effusion frequently coexist (see Chaps. 31 and 67). Most rheumatoid nodules are less than 2 cm in diameter and show a preference for the subpleural regions of the lung. Pathologically, rheumatoid nodules show a distinctive three-layered architecture. The core of the lesion shows fibrinoid necrosis admixed with dust-laden machrophages and collections of foamy histiocytes. Peripheral to the core, there is a layer of elongated histiocytes in a palisade arrangement. The outermost layer consists of granulation tissue or fibrosis with collections of lymphoyctes and plasma cells. Blood vessels near rheumatoid nodules show distinct intimal fibrosis, frequently to the point of obstruction. Rheumatoid nodules can persist indefinitely, disappear spontaneously, recur, or cavitate. They are frequently excised because of the suspicion of tumor.

The designation of Caplan syndrome was originally applied to the combination of coal worker's pneumoconioses, rheumatoid arthritis, and rheumatoid nodules; the latter can be as large as 5.0 cm in diameter. These nodules usually occur in patients with category 0 or 1 of coal worker's pneumoconiosis (see Chap. 34). Similar lesions can occur in patients who have silicosis and asbestosis.

Lesions of progressive massive fibrosis classically are seen in coal worker's pneumoconiosis, they have been described in Chapter 34. Comparable lesions are also recognized in complicated forms of silicosis (see Chap. 35).

Amyloidoma

In nodular amyloidosis, multiple lesions are more common than isolated lesions. The disease is bilateral in 50% of patients. The lesions tend to be peripherally located and usually measure between 3 and 6 cm, but they can be as large as 16 cm in diameter (see Chap. 32).

Pulmonary Hyalinizing Granuloma

Pulmonary hyalinizing granuloma was described by Engleman and colleagues in 1977 in 20 patients.[63] The lesions consisted of multiple, bilateral, mildly symptomatic nodules. Remarkably, four patients had associated fibrosing mediastinitis, and one other patient had retroperitoneal fibrosis and amyloidosis. The patient described by Drassin and colleagues developed malignant lymphoma, multiple myeloma, and systemic amyloidosis following the diagnosis of pulmonary hyalinizing granuloma.[64]

Microscopically, pulmonary hyalinizing granuloma is composed of pink or hyaline lamellae that run a parallel course or have a perivascular disposition. Mild perivascular inflammation and collections of lymphocytes and plasma cells are seen at the periphery of the lesion. The dense, hyaline material is negative for amyloid in a majority of lesions; the lesions do not calcify, ossify, or develop foreign-body granulomas, as amyloid does. Other significant differences include the significantly younger age of the patients who had hyalinizing granulomas and the association with fibrosing mediastinitis and retroperitoneal fibrosis.[46,63–67]

Lipoid Granuloma

Aspiration of lipid material can occur in infants and adults. In infants, lipid aspiration is usually the result of milk aspiration, usually followed by infection. In adults, lipid aspiration is usually observed in patients with a history of habitual self-administration of oily substances in the form of nasal drops or sprays; chronic ingestion of mineral oil is another well recognized hazard (see Chap. 19).

Lipid aspiration in the adult elicits acute stage inflammatory changes with eventual progression to one of several masses of hard tissue—showing foreign-body granulomas, fibrosis, and hyalinization. Radiologically and also by palpation, the masses resemble tumors. Moreover, atypical histiocytes may be found in the sputum or bronchial washings; they can be erroneously interpreted as malignant cells.[68,69]

Localized Radiation Fibrosis

Diffuse interstitial pneumonia and interstitial fibrosis are well-recognized complications of radiation injury to the lungs, as discussed in Chapter 15. Localized infiltrates and fibrotic masses can follow irradiation to a localized portion of the lung. Most common are unilateral apical lesions in women with breasts who have received axillary radiation for nodal metastases. Bilateral apical fibrosis can follow irradiation to the neck for lymphoma or carcinoma. The hilar regions can be affected in a similar manner following irradiation to the mediastinum. Failure to document prior episodes of radiation therapy results in biopsy of these lesions for the suspicion of malignancy. The biopsy usually shows interstitial fibrosis, striking alveolar cell atypia, and obliterative changes of the pulmonary vessels.[70–72]

Apical Caps

In about 20% to 25% of adults examined at necropsy, the apices of the lungs are replaced by a flat, shell-like layer of tissue to which the designation apical cap is applied. Sometimes, an apical cap can be so prominent as to prompt a biopsy. The latter will show hyalinization, elastosis, collections of dust-pigmented macrophages, and foci of calcification.[72–74] The presence of apical caps is enhanced by the coexistence of centrilobular emphysema and bullae. The possibility that some apical cancers (e.g., Pancoast tumors) arise in relation to apical caps has been proposed but remains unproven.[75]

The pathogenesis of the apical cap is obscure, but the possibility of tuberculosis has been ruled out; an alternative view is that apical caps represent a nonspecific response of the pulmonary apex to a situation of chronic, relative ischemia.

REFERENCES

1. Carter D, Eggleston JG. Inflammatory pseudotumor. Tumor of the lower respiratory tract. Washington, DC: Armed Forces Institute of Pathology, 1980:300.
2. Umikar WO, Iverson L. Post-inflammatory tumors of the lung: report of four cases simulating xanthoma, fibroma, or plasma cell tumor. J Thorac Surg 1954;28:55.

3. Bahadori M, Liebow AA. Plasma cell granulomas of the lung. Cancer 1973;31:191.
4. Spencer H. The pulmonary plasma cell/histiocytoma complex. Histopathology 1984;8:903.
5. Matsubara O, Tan-Liu NS, Kenney RM, Mark EJ. Inflammatory pseudotumors of the lung: progression from organizing pneumonia to fibrous histiocytoma or to plasma cell granuloma in 32 cases. Hum Pathol 1988;19:807.
6. Baker AP, Carter MJ, Matz LR, Armstrong JA. Plasma-cell granuloma of the trachea. Med J Aust 1987;146:443.
7. Chou P, Gonzalez-Crussi F, Cole R, Reddy VB. Plasma cell granuloma of the heart. Cancer 1988;62:1409.
8. Issacson P, Buchanan R, Mepham BL. Plasma cell granuloma of the stomach. Hum Pathol 1978;9:355.
9. Chen KTK. Inflammatory pseudotumor of the liver. Hum Pathol 1984;15:694.
10. Abrebanel P, Sarfaty S, Gal R, Chaimoof C, Kessler E. Plasma cell granuloma of the pancreas (letter). Arch Pathol Lab Med 1984; 108:531.
11. Sheahan K, Wolf BC, Neiman RS. Inflammatory pseudotumor of the spleen: a clinicopathologic study of three cases. Hum Pathol 1988; 19:1024.
12. Facchetti F, Peeters CDW, Wever ID, Frizzera G. Inflammatory pseudotumor of lymph nodes, immunohistochemical evidence for its fibrohistiocytic nature. Am J Pathol 1990;137:281.
13. Fisch AE, Brodey PA. Plasma cell granuloma of the kidney. Urology 1976;8:89.
14. Wu JP, Yunis EJ, Fetterman G, Jaeschke WF, Gilbert EF. Inflammatory pseudo-tumours of the abdomen: plasma cell granulomas. J Clin Pathol 1973;26:943.
15. Case Records of the Massachusetts General Hospital (Case 13-1984.) N Engl J Med 1984;310:839.
16. Kunakemakorn P, Ontai G, Balin H. Pelvic inflammatory pseudotumor: a case report. Am J Obstet Gynecol 1976;126:296.
17. Eimoto T, Yanaka M, Kurosawa M, Ikeya F. Plasma cell granuloma (inflammatory pseudotumor) of the spinal cord meninges. Report of a case. Cancer 1978;41:1929.
18. West SG, Pittman DL, Coggin JT. Intracranial plasma cell granuloma. Cancer 1980;46:330.
19. Yapp R, Linder J, Schenken JR, Karrer WF. Plasma cell granuloma of the thyroid. Hum Pathol 1985;16:848.
20. Heathcoate JG, Allen LH, Willis NR. Plasma cell granuloma of the lacrimal sac. Can J Ophthalmol 1987;22:387.
21. Hurt MA, Cruz DJS. Cutaneous inflammatory pseudotumor. Lesions resembling "inflammatory pseudotumors" or "plasma cell granulomas" of extracutaneous sites. Am J Surg Pathol 1990;14:764.
22. Golbert SV, Pletnev SD. On pulmonary pseudotumors. Neoplasma 1967;14:189.
23. Hartman GE, Schochat SJ. Primary pulmonary neoplasms of childhood: a review. Ann Thorac Surg 1983;36:108.
24. Pettinato G, Manivel JC, Rosa ND, Dehner LP. Inflammatory myofibroblastic tumor (plasma cell granuloma). Clinicopathologic study of 20 cases with immunohistochemical and ultrastructural observations. Am J Clin Pathol 1990;94:538.
25. Monzon CM, Gilchrist GS, Burgert EO, et al. Plasma cell granuloma of the lung in children. Pediatrics 1982;70:268.
26. Berardi RS, Lee SS, Chen HP, Stines GJ. Inflammatory pseudotumors of the lung. Surg Gynecol Obstet 1983;156:89.
27. Shirakawa T, Fukuda K, Takenaka S, et al. Two cases of inflammatory pseudotumor of the lung with a review of 46 cases reported in the Japanese literature. Nippon Kyoubu Shikkan Gakkai Zasshi 1989;27:1342.
28. Sweetman WR, Hartley LJ, Bauer AJ, Salyer JM. Postinflammatory "tumor" of the lung. Report of a case simulating malignant thymoma. J Thorac Surg 1958;35:802.
29. Warter A, Satge D, Roeslin N. Angioinvasive plasma cell granulomas of the lung. Cancer 1987;59:435.
30. Kuzela DC. Ultrastructural study of a post inflammatory "tumor" of the lung. Cancer 1975;36:149.
31. Buell R,, Wang N-S, Seemayer TA, Ahmed MN. Endobronchial plasma cell granuloma (xanthomatous pseudotumor): a light and electron microscopic study. Hum Pathol 1976;7:411.
32. Shirakusa T, Miytazaki N, Kitagawa T, Sugiyama K. Ultrastructural study of plasma cell granuloma: report of a case. Br J Dis Chest 1979;73:289.
33. Mohsenifar Z, Bein ME, Mott LJM, Tashkin DP. Cystic organizing pneumonia with elements of plasma cell granuloma. Arch Pathol Lab Med 1979;103:600.
34. Janigan DJ, Marrie TJ. An inflammatory pseudotumor of the lung in Q fever pneumonia. N Engl J Med 1983;308:86.
35. Harjula A, Mattila S. Kyoesola K, Heikkilae L, Maekinen J. Plasma cell granuloma of lung and pleura. Scand J Thorac Cardiovasc 1986; 20:119.
36. Loo KT, Seneviratne S, Chan JKC. Mycobacterial infection mimicking inflammatory pseudotumor of lung. Histopathology 1989;14: 217.
37. Roikjaer O, Thomsen JK. Plasmacytoma of the lung. A case report describing two tumors of different immunologic type in a single patient. Cancer 1986;58:2671.
38. Koss MN, Hochholzer L, Nichols PW, Wehunt WD, Lazarus AA. Primary non-Hodgkin's lymphoma and pseudolymphoma of the lung: a study of 161 patients. Hum Pathol 1983;14:1024.
39. Weiss LM, Yousem SA, Warnke RA. Non-Hodgkin's lymphomas of the lung. Am J Surg Pathol 1985;9:480.
40. Yousem SA, Weiss LM, Colby TV. Primary pulmonary Hodgkin's disease: a clinicopathologic study of 15 cases. Cancer 1986;57:1217.
41. Lee JT, Shelburne JD, Linder J. Primary malignant fibrous histiocytoma of the lung: a clinicopathologic and ultrastructural study of five cases. Cancer 1984;53:1124.
42. Yousem SA, Hochholzer L. Malignant fibrous histiocytoma of the lung. Cancer 1987;60:2532.
43. Tan-Liu N, Matsubara O, Grillo HC, Mark EJ. Invasive fibrous tumor of the tracheobronchial tree: clinical and pathologic study of seven cases. Hum Pathol 1989;20:180.
44. Sajjar SM, Begin LR, Dail DH, Lukeman JM. Fibrous histiocytoma of lung: a clinicopathologic study of two cases. Histopathology 1981; 5:325.
45. Yousem SA, Hochholzer L. Pulmonary hyalinizing granuloma. Am J Clin Pathol 1987;87. 1.
46. Blesovsky A. The folded lung. Br J Dis Chest 1966;60:19.
47. Hanke R. Rund Atelektasen (Kugel-Und Walzenatelektasen): ein Beitrag zur Differentialdiagnose intrapulmonaler Rundherde. Fortschr Rontgenstr 1971;114:164.
48. Kretzschumar R. Ueber atelektatische Pseudotumoren der Lunge. Fortschr Roentgenstr 1975;122:19.
49. Sinner WN. Pleuroloma—a cancer-mimicking atelectatic pseudotumor of the lung. Fortschr Roentgenstr 1980;133:578.
50. Payne Cr, Jaques P, Kerr IH. Lung folding simulating peripheral pulmonary neoplasm (Bleskovsky's syndrome). Thorax 1980;35:936.
51. Chou S-R, Henry DA, Beachley MC, Brooks JW. Round (helical) atelectasis. Br J Radiol 1981;54:643.
52. Start P. Round atelectasis: another pulmonary pseudotumor. Am Rev Respir Dis 1982;125:248.
53. Dernevik L, Gatzinsky P, Hultman E, Selin K, William-Olsson GW, Zettergren L. Shrinking pleuritis with atelectasis. Thorax 1982;37:252.
54. Loeschke H. Stoerungen des Luftgehalts der Lunge. In: Henke-Lubarsch J, Lubarsch O, ed. Handbuch der spezielen pathologischen Anatomie und Histololgie, III/1. Berlin: Springer-Verlag, 1928:599.
55. Schuemmelfeder N. Umfaltungen und Verwachsungen an freien Lungenrandern. Beitr Pathol Anat 1956;116:422.
56. Roche G, Parent J, Daumet P. Atelectasies parcelliares du lobe inferieur et du lobe moyen au cours du pneumothorax therapeutiques. Rev Tuberc (Paris) 1956;20:87.
57. Heine F. Faltungsphaenomene der Lunge. Internist 1962;3:357.

58. Hanke T, Kretzschmar R. Rounded atelectasis. Semin Roentgenol 1980;15:174.
59. Schneider HJ, Felson B, Gonzalez LL. Rounded atelectasis. Am J Roentgenol 1980;134:225.
60. Case Records of the Massachusetts General Hospital. Case 24-1983. N Engl J Med 1983;308:1466.
61. Mintzer RA, Gore RM, Vogelzang RL, Holz S. Rounded atelectasis and its association with asbestos-induced pleural disease. Radiology 1981;139:567.
62. Mintzer RA, Cugell DW. The association of asbestos-induced pleural disease and rounded atelectasis. Chest 1982;81:457.
63. Engleman P, Liebow AA, Gmelich J, et al. Pulmonary hyalinizing granuloma. Am Rev Respir Dis 1977;115:997.
64. Drasen H, Blume MR, Rosenbaum EH, et al. Pulmonary hyalinizing granulomas in a patient with malignant lymphoma with development nine years later of multiple myeloma and systemic amyloidosis. Cancer 1979;44:215.
65. Guccion JG, Rohatgi PK, Saini N. Pulmonary hyalinizing granuloma. Electron microscopic and immunologic studies. Chest 1984;85:571.
66. Patel Y, Ishikawa S, MacDonnell KF. Pulmonary hyalinizing granuloma presenting as multiple cavitary calcified nodules. Chest 1991;100:1720.
67. Kuramochi S, Kawai T, Yakumaru K, et al. Multiple pulmonary hyalinizing granulomas associated with systemic idiopathic fibrosis. Acta Pathol Jap 1991;41:375.
68. Tunell WP, Blades BB. Asynchronous bilateral lipoid pneumonia presenting as solitary nodules in the lung. J Thorac Cardiovasc Surg 1972;63:334.
69. Didolkar MS, Gamarra MC, Hartmann RA, Takita H. Lipoid granuloma of the lung. Clinicopathologic observations. J Thorac Cardiovasc Surg 1973;66:122.
70. Gross NJ. Pulmonary effects of radiation therapy. Review. Ann Intern Med 1977;86:81.
71. Fajardo LF, Berthrong M. Radiation injury in surgical pathology I. Am J Surg Pathol 1978;2:159.
72. Shapiro SJ, Shapiro SD, Mill WB, Campbell EJ. Prospective study of long-term pulmonary manifestations of mantle irradiation. Int J Radiat Oncol Biol Phys 1990;19:707.
73. Renner RR, Markarian B, Pernice NJ, Heitzman ER. The apical cap. Radiology 1974;110:569.
74. Butler CI, Kleinerman J. The pulmonary apical cap. Am J Pathol 1970;60:205.
75. Solovay J, Solovay HV. Apical pulmonary tumors—relationship to apical scarring. Dis Chest 1965;48:20.