mean duration of exposure to asbestos in 7 patients was 35 years. Carcinoma of the lung occurred most frequently in the right upper lobe (6 cases). Five patients had a history of cigarette smoking for 20 years or longer. There was no predominant cell type of carcinoma of the lung in our series. Death was most commonly attributed to bronchopneumonia, lung abscess, and cor pulmonale.

DISCUSSION

Asbestos is a magnesium silicate that is one of a group of silicate minerals of crystalline fibrillar structure.[18] Industrially, the material is found in asbestos mining and in many industries engaged in the processing and manufacturing of asbestos products. These include insulating materials (fire resistant cloths, ropes, millboard, wallboard, mortar, and other products). The principal hazard in these industries consists of inhalation of the asbestos dust.

Some regard pulmonary asbestosis as a form of pneumoconiosis not necessarily accompanied by symptoms, whereas others feel the term should be reserved for cases in which clinical manifestations are present.[25] The development of pulmonary lesions that are characterized by fibrosis and the formation of the so-called asbestos body depends upon the duration and degree of exposure to asbestos dust.[5] Lynch[19] provided a careful description of the pathogenesis of the disease and classified it into 4 stages. The lesions may appear after 3 to 15 years' exposure but may not produce symptoms for many years.[13] There is considerable individual variation in susceptibility, some individuals developing the disease rapidly while others may be exposed for years without evidence of pulmonary involvement. Symptoms of the disease consist of dyspnea, cough with expectoration, pallor, cyanosis, palpitation, weight loss, and chest pain.[26, 27] Characteristic changes of pneumoconiosis may be seen on roentgenographic examination.

The pathognomonic asbestos bodies are found in the interstitial connective tissue of the lung and in peribronchial and hilar lymph nodes.[6, 18] They consist of a central translucent fiber, 10 to 100 μ in length and 1 to 12 μ in diameter, enclosed in a golden-brown encrusted sheath composed of an iron protein compound. The ends are usually bulbous. The fibers may be surrounded by macrophages or giant cells. The fibrosis that accompanies the deposition of asbestos fibers tends to progress even after exposure to inhalation has been discontinued.

The exact nature of the association between asbestosis and pulmonary carcinoma has been difficult to unravel. Since the first report by Lynch and Smith,[21] many observations have been made concerning this relationship,[4, 6-8, 10-14] with the use of several different approaches to the problem.

It has been shown in a series of studies that there is a statistically proved higher incidence of carcinoma of the lung in patients with asbestosis than in the general population. One such study, the results of which are given in the Annual Report of the Chief Inspector of Factories for the Year 1947 in Great Britain, established that carcinoma of the lung occurs in 13% of cases of asbestosis in contrast to the 2 to 6% incidence in the general population.[9]

Doll,[4] in similar studies, arrived at the conclusion that the risk of developing carcinoma of the lung was higher in individuals exposed for a long period of time to asbestos inhalation. Nordmann,[23] who published data on 6 cases, went even further to state that carcinoma of the lung is an occupational disease among people engaged in asbestos work. This opinion was also expressed by Hornig.[12]

The second point of interest concerns the multifocal development of cancer in these cases pointed out by Nordmann,[23] Gloyne,[8] and Hueper.[13] This feature has often characterized the malignant tumors found in asbestosis and has also been noted in 2 of the cases presented in this report.

Finally, the age–time exposure relationship has supported the idea of a causal relationship. The longer the exposure to asbestos, the greater the risk of developing a malignant tumor; and the younger the individual when first exposed to asbestos dust, the earlier is the development of the pulmonary carcinoma. However, this relationship is not invariably found.

As shown in the cases presented, 4 of the individuals had no known history of direct exposure to asbestos dust, and the diagnosis of asbestosis was made based entirely on the histological findings of pulmonary fibrosis associated with the presence of asbestos bodies. There are no documented cases in the literature to our knowledge of cases of asbestosis associated with carcinoma of the lung in which the patient had not been exposed at one time or another directly to asbestos dust, either in