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Case Report of Asbestos Exposure-Related Lung Carcinoma

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ABSTRACT *: A 61 year-old female patient was hospitalized for lung cancer. Her occupational history indicated that she had worked for an asbestos company for 9 years from 1976. The histopathology of the lung revealed malignant bronchioalveolar adenocarcima (stage III) in the lower-left lobe, and a lung sample was found to contain an unusually high level of asbestos, 218.9×10^6 asbestos fibers/g of dry lung tissue. The majority of asbestos fibers found was chrysotile, yet no asbestos body was detected. When compared with Korean male (0.3×10^6 fibers/g of dry lung tissue) and female subjects (0.15×10^6 fibers/g of dry lung tissue) with no known history of occupational asbestos exposure, the apparent cause of the lung cancer in the current patient was occupational exposure to asbestos.*

Key Words *: Asbestos, Chrysotile, Lung cancer, Adenocarcinoma, Occupational disease*

I. INTRODUCTION

Previous epidemiologic studies have indicated that there is a definite association between heavy occupational exposure to asbestos and an excess risk of lung cancer (McDonald, 1980, 1986, 1990, 1993). The clinical features of the carcinomas found in asbestos exposed workers, apart from manifestations of asbestosis and a benign pleural disease, would appear to be same as those seen in individuals without occupational exposure to asbestos. Although the majority of ordinary cigarette smoke-induced lung tumors occur in the upper lobes (approximate upper to lower lobe ratio 1 : 1.5), the site specificity of asbestos exposure-induced lung tumors is still controversial (Churg and Green, 1998). Although there is still a great deal of discussion on relating specific types of carcinoma with occupational asbestos exposure, the observations made by Churg (1998) are very persuasive. He observed that the cell type bears no relation to whether or not a given case was caused by exposure to asbestos, and made the following three observations; (a) There is no consistent evidence that can link tumors to asbestos exposure. (b) Asbestos-related tumors can occur in any lobe. (c) Cell-type data indicate that all carcinoma types occurring in cigarette smokers can also occur in asbestos workers.

Since the first case of asbestos-related lung cancer (Jung *et al.*, 1994), relatively few cases of asbestos exposure related diseases have been reported among asbestos workers (Park *et al.*, 1995, Ahn *et al.*, 1997, Lee *et al.*, 2001b). Some of these papers were lack of asbestos concentrations in the lung tissues to relate tumors to asbestos exposure. The concentration asbestos fibers in the lung tissue along with histopathology could be critical diagnostic criteria for asbestos exposure related diseases. The current paper reports on a case of asbestos exposure-related lung adenocarcinoma.

A 61-year-old woman who had been employed in an asbestos manufacturing company for nine years from 1976 was diagnosed with lung cancer. After a lower-left lobe lobectomy, her cancer was confirmed as stage III bronchioalveloar carcinoma in May, 1999.

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The patient worked on the inspection and correction of asbestos containing fire-proof textile. The patient could have been exposed to high concentrations of asbestos containing dusts according to the patients recollection in which the dusts were so dense that they could not see other workers on the opposite side. The workplace concentrations of asbestos from 1977~1986 were not known exactly. The company does not manufacture asbestos textile products anymore and only produces gaskets. The patient did not smoke and had no obvious disease history. She was given six rounds of anticancer treatment based on taxol until February, 2000, however, there was no sign of improvement and the cancer became aggravated. The patient was initially diagnosed as AFB (acid fast bacillus) negative on May 11, 2000, then became AFB +++ and stage IV bronchioalveloar carcinoma on May 19. 2000. Although tuberculosis medication was administered, the patient died on June 29, 2000.

Based on multiple sections of specimens obtained from the lobectomized lower-left lobe of the lung, a diffusely ill-defined gray to whitish solid tumor mass, measuring 7×3 cm in diameter, was observed 4 cm from the bronchial surgical margin and near to the pleural surface. The external surface was grossly unremarkable. The histopathology of the specimen showed bronchioalveolar-type adenocarcinoma metastasized to the local lymph nodes with a grading of 5/8. Cuboidal cells replaced the alveolar lining cells, and the septa exhibited a slight fibrous thickening. The alveolar spaces also contained some exfoliated tumor cells (Figs. 1 A and B).

The samples were also processed to determine the asbestos content in the lung tissue using a transmission electron microscope (TEM) equipped with an energy dispersive X-ray analyzer (EDX). The samples were prepared according to the method described by Yu *et al.* (1998) (Fig. 2). The TEM-EDX analysis revealed many asbestos fibers (Figs. 3 A and B) as follows: 211×10^6 chrysotile fibers, 1×10^6 amosite fibers, 1.9×10^6 crocidolite fibers, 3.9×10^6 actinolite fibers, 1.9×10^6 tremolite fibers, and 1.0×10^6 anthophyllite fibers/g of dry lung tissue. The majority of asbestos

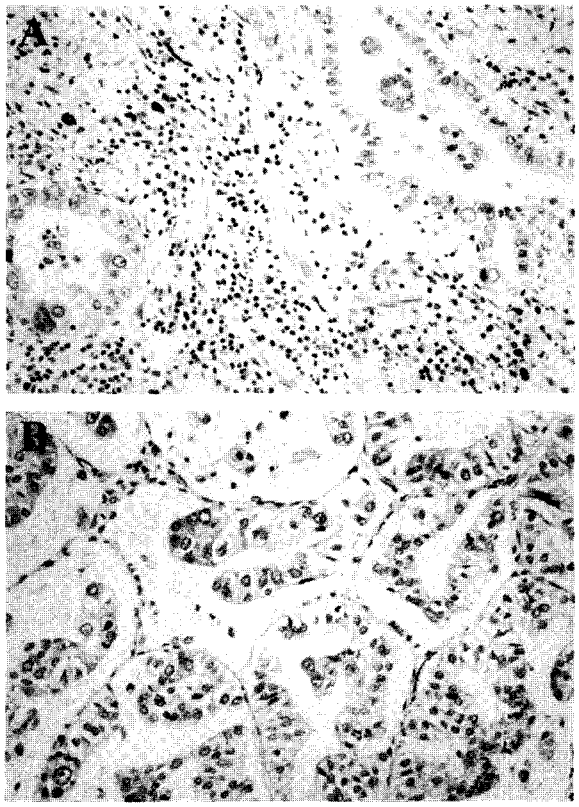

Fig. 1. Histopathology of lobectomized lung sample (200×, H-E staining).

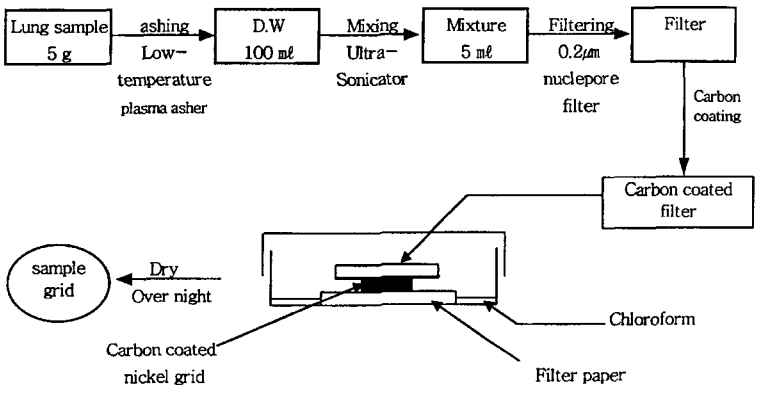

Fig. 2. Lung sample preparation for TEM-EDX analysis.

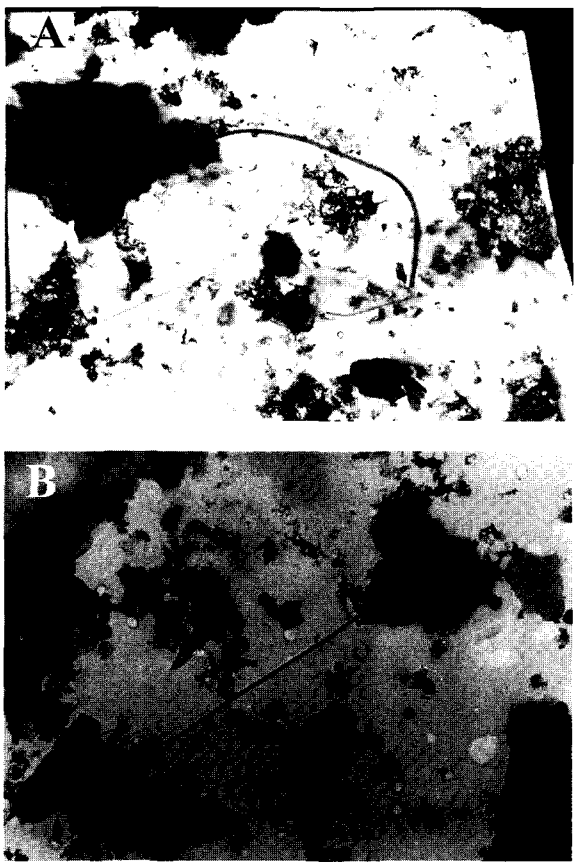

Fig. 3. Asbestos fibers detected in TEM (10,000×).
A. Curved-shaped chrysotile fiber.
B. Long and thin chrysotile fiber.

fibers found were chrysotile (Fig. 4). No asbestos body was detected. The total number of asbestos fibers in the lung tissue of the patient was 218.9×10^6 asbestos fibers/g of dry lung tissue, compared to 0.3×10^6 asbestos fibers/g of dry lung tissue in the general Korean population (Yu *et al.*, 1998). This is the first case of histopathologically diagnosed adenocarcinoma caused by occupational exposure to asbestos.

Since asbestos has been used in Korea for more than 30 years, occupational diseases caused by asbestos have recently become more frequent. As such, requests for asbestos analyses of biological samples as well as environmental samples have also increased. In the current year, four workers, including a plumber and three welders, were officially diagnosed with occupational cancer caused by asbestos exposure. Since the first report of asbestos exposure-related cancer in 1993 (Lee, 2001), a total of 17 workers have been diagnosed with occupational cancer caused by asbestos exposure in Korea. Accordingly, the Korean Ministry of Labor has determined to impose stricter regulations from 2002 regarding the use of asbestos, along with the requirement for special training when handling asbestos-containing materials. In addition, the occupational exposure limit of asbestos will be lowered from current 2 fibers/cc to 0.1 fibers/cc in 2003 (Lee, 2001a).

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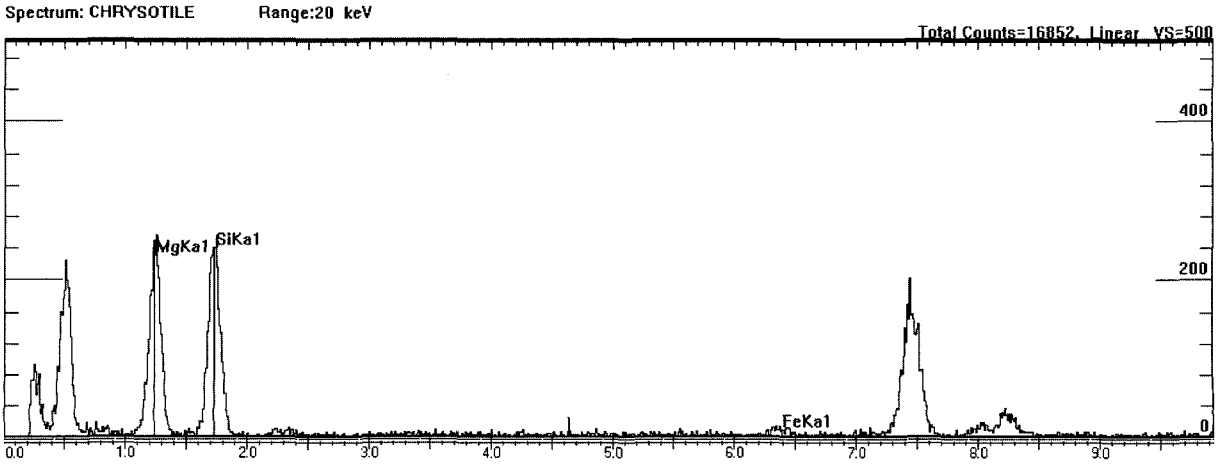

Fig. 4. EDX pattern of chrysotile fibers.

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