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Malignant Peritoneal Mesothelioma Following Asbestos Exposure

Osman Manavoğlu,[1] Bülent Orhan,[1] Türkkan Evrensel,[1] Tülay Özçelik,[2] Ibrahim Yolcu,[2] and Esra Kunt[2]

Clinical, epidemiological, and pathological studies have demonstrated that asbestosis plays a major role in the etiology of mesothelioma. The direct exposure of workers in industrialized countries to asbestos fibers and nonoccupational household contact elevate the risk of malignant mesothelioma. An increased risk has been found in certain geographic areas of Turkey due to the presence of asbestos deposits and the use of the material known as "white soil" as an insulation. We present a malignant mesothelioma case from rural eastern Turkey with a history of asbestos exposure from using "white soil". We review the epidemiological aspects of asbestos as they relate to mesothelioma.

KEY WORDS: malignant mesothelioma, peritoneal mesothelioma, asbestos exposure, asbestos and cancer, mesothelioma and asbestos exposure.

Introduction

Malignant mesothelioma is a tumor that arises from the mesothelial cells lining the body cavities.[1] It can occur in any body cavity, most frequently in the pleura and the peritoneum, but can also occur in the pericardium and tunica vaginalis of the testis.[1–4] This tumor is difficult to diagnose and has a poor prognosis. The incidence of mesothelioma appears to be increasing, and its relationship with environmental and occupational asbestos exposure has been documented.[1] The relationship between asbestos fibers and malignant pleural and peritoneal mesothelioma has been studied intensively since the original observation by Wagner et al.[5] Asbestos exposure continues to be the primary cause of pleural, peritoneal, and probably also epididymal mesothelioma.[1,6] We describe a case of malignant mesothelioma, a rare disease in a 52-year-old woman. The diagnosis was based on light microscopy, CT findings, bronchoalveolar lavage, and evaluation of the clinical course. Exposure to asbestos filaments was suspected because of the patient's history and traces of asbestos were found in the bronchoalveolar lavage. The case is reviewed here because of its rarity and its relationship to environmental factors that present a public health problem in Turkey.

Case History

A 52-year-old housewife from the village of Diyarbakir, located in southwestern Turkey, was admitted to the Gastroenterology Department of Uludağ University Faculty of Medicine with the chief complaint of abdominal distention and pain lasting 1 year. She described the pain as starting from the periumbilical region, radiating throughout her entire abdomen, and lasting for hours. During the last three months, she noticed a slowly progressing abdominal distention and, after this finding, was admitted to the hospital.

Personal history: She grew up in Diyarbakir in the southeast part of Turkey and lived in that district until 30 years of age. She gave a history

[1]Department of Medical Oncology, Uludağ University Medical School. [2]Department of Internal Medicine, Uludağ University Medical School, Bursa, Turkey. Address all correspondence to Prof. Dr. Osman Manavoğlu, Department of Medical Oncology, Uludağ University Medical School, Görükle, Bursa, Turkey.

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of using "white soil" as an insulation material on her house walls. Her family history was unremarkable for pathological findings. *Physical examination*: Ascites and tenderness on palpation of the abdomen was found with no guarding or rebound tenderness. No other pathological findings were found.

Diagnostic work-up: CEA: 0.2 ng/mL (Nl = 0.5–2), CA-125: 334 U/mL (Nl = 0–35), CA 19–9: 20 U/mL (Nl = 1–37), CA 72–4: 1 U/mL (Nl = 1–4). *Abdominopelvic ultrasonography*: A 4-cm cyst with a thick wall was seen in the right ovary and a 14-mm solid mass was seen in the anterior part of the uterus. *Abdominopelvic Computerized Tomography (CT)*: A large amount of ascites was found. Peritoneal implants and infiltration of the omentum were noted in the anterior part of the abdomen. A mass 5 × 4 cm in diameter with cystic and solid components was found in the right part of the uterine fundus. No pelvic or paraaortic lymphadenopathy and no metastases to the liver or other intraabdominal organs were identified. Bone scintigraphy revealed no evidence of bone metastases.

Based on the radiological findings and the elevated CA-125 level, a probable diagnosis of ovarian cancer was formulated.

At laparotomy there was a 2 × 2 cm tumoral mass in front of the uterus, invading the sacrouterine ligaments. A tumoral mass 4 × 4 cm in diameter was seen in the Douglas pouch and a tumoral mass 3 × 4 cm was seen in the mesocolon of the descending colon. Another tumoral mass 4 × 4 cm was found in the omentum. The subdiaphragmatic surface was studded with tumoral implants less than 1 cm in diameter. A total abdominal hysterectomy, bilateral salphingoopherectomy omentectomy, and tumoral mass excision were performed.

The histopathological examination of the tumoral mass showed a malignant mesothelioma. Her history of using "white soil" as an insulation material was thought to be the source of asbestos exposure. A thoracic CT scan was performed that revealed bilateral pleural thickening, calcifications, and linear opacities in the inferoposterior part of the right lung, probably due to asbestosis. A bronchoalveolar lavage produced a 12.4 mL asbestos clump, indicating high exposure to asbestos. The bronchial lavage cytology was benign.

Discussion

The word asbestos is derived from the Greek word *asbestinon* (incombustible), owing to its resistance to heat and combustion. Asbestos is the commercial name for hydrated magnesium silicate fiber, categorized as either serpentine or amphibole minerals,[1,6] depending on whether they are curved or straight (Table 1). Asbestos minerals appear to provoke carcinogenesis because of their physical composition. The long rod-like fibers with narrow diameter are thought to induce tumors in laboratory animals. After entering the airways, most fibers are eliminated by coughing or by swallowing and elimination in the feces. The remaining fibers in the lungs are ingested by macrophages, liberating free radicals and lysosomal enzymes, which initiate an inflammatory and fibrotic process. Protooncogenes are upregulated from alveolar macrophages in the fibrotic lungs that enhances mesothelial cell proliferation.[1,6–8] It is not known how asbestos fibers are transported into the peritoneum. It is thought that the fibers are transported from the lung via lymphatics and that swallowed filaments are transferred into the peritoneal cavity across the gut mucosa. Peritoneal mesothelioma occurs only in patients exposed to amphiboles, probably because chrysotile fibers disintegrate in the abdominal tissue.[7]

The link between asbestos, asbestosis, and pleural and peritoneal mesothelioma are well established. Asbestos-related diseases are seen in people exposed to asbestosis (Table 2).[1,2,6,7] Asbestos minerals adsorb hydrocarbons that may increase the risk of lung cancer in people who smoke and are exposed to asbestos fibers. The risk of lung cancer in smokers with a history of asbestos exposure increases almost 60 times compared to smokers without asbestos exposure.[9] A higher incidence of gastrointestinal and laryngeal cancer has been reported in individuals exposed to asbestos, but whether this is a direct or casual relationship is undetermined.[6,10–12]

TABLE 1. Classification of Asbestos Minerals.

Serpentine minerals (curly and pliable)	Amphibole minerals (straight, needle-like fibers)
Chrysotile	Crocidolite Amosite Anthophylite Tremolite Actinolite

TABLE 2. Established Asbestos-Related Diseases.

Asbestosis	
Pleural reactions	
Pleural effusions	Pleural thickening
Malignant Mesotheliomas	
Pleural	Peritoneal
Pericardial	Testicular
Other Neoplastic Diseases	
Carcinoma of the bronchus	
Extrapulmonary carcinomas (gastrointestinal and laryngeal carcinoma)	

A diagnosis of peritoneal mesothelioma depends mostly on the clinical evaluation and histopathological studies. There is no specific clinical or radiological finding for this disease. CT findings may be important in evaluating pleural malignant mesothelioma. However, in peritoneal malignant mesothelioma, various nonspecific findings such as ascites, pancreatic masses, peritoneal nodules, and omental infiltrations may be seen.[13–18] No specific tumor markers for malignant mesothelioma have been reported in the literature.

Asbestos exposure continues to be the primary cause of pleural and peritoneal mesothelioma.[6,19–23] The risk is related to the duration and intensity of the exposure.[6,18,20,21] Thus, those exposed at a younger age are at higher lifetime risk.[2,24] Dust concentration, the duration of exposure, and a person's cellular or humoral immunity play a role in the progression of asbestos-related disease. Occupational exposure is the main problem in Europe and the U.S.[1,6,10,19,25] The families of asbestos workers are also at risk because of the workers' asbestos-exposed hair and clothing.[6] Asbestos items brought home from the work place also constitute a risk.

Unlike malignant mesothelioma that is caused by occupational exposure in developed countries such as the U.S., malignant mesothelioma in Turkey is mostly caused by environmental exposure.[2,13,26] The type of asbestos responsible for malignant mesothelioma in cases of occupational exposure is chrocidolite or amosite, but environmental exposure-related malignant mesothelioma is usually caused by tremolite.[26,27] Erionite, a natural fibrous zeolite, has been shown to cause malignant mesothelioma in central Turkey. There are many asbestos deposits in rural parts of central and eastern Anatolia. The types of asbestos found in these regions, tremolite or chrysolite, have no economic value.[2,26] Inhabitants use tremolite asbestos contaminated soil (called white soil) as a whitewash, a substitute for baby powder, or a plastering material used on roofs as insulation or to prevent water leaks. One of the most important routes of domestic exposure is the dust from the walls of homes whitewashed with tremolite-contaminated soil. Turkish and Greek villagers also used this soil in the past as a white stucco because of its brilliance and because it does not stain easily.[2] The major occupations of the residents in rural central and eastern Anatolia are agriculture and livestock breeding. It is clear that in these areas there is no occupational exposure to asbestos or from the use of asbestos-contaminated products, so we can assume that cases of malignant pleural or peritoneal mesothelioma are caused by environmental exposure.

Our case was typical of environmental exposure-related malignant peritoneal mesothelioma, because there is no history of occupational exposure to asbestos. Our patient lived in a rural area in eastern Turkey and had no family history of occupationally asbestos-exposed family members. She did have, however, a history of using "white soil" to insulate walls. A latency period of about 30 years is the expected latent period of time reported in the literature for the carcinogenic effect of asbestos filaments to occur. The CT findings of benign asbestos plaques in the lung and the presence of amphibole asbestos filaments in the bronchoalveolar lavage may support the diagnosis of asbestos exposure-related peritoneal mesothelioma.

The elevated CA-125 level was an unexpected finding in this patient as this antigen has not been reported as a specific tumor marker for malignant peritoneal mesothelioma.

In conclusion, malignant peritoneal mesothelioma, although a rare tumor, should be considered when evaluating a slowly growing abdominal mass in residents of areas where asbestos-related malignant mesothelioma is endemic. It is important to question patients about the possible exposure to asbestos fibers, especially in countries such as Turkey where asbestos-related diseases are a public health problem.

References

1. Antman KH, Li PF, Pass HI, Corson J, Delaney T. Benign and malignant mesothelioma. In: DeVita VT Jr, Hellman S, Rosenberg SA, eds. Cancer: principles and practice of oncology. Philadelphia: J B Lippincott, 1993; 1489–1508.
2. Bariş YI, ed. Asbestos and Eritonite-related chest diseases. Ankara: Semih matbaacilik, 1987; 113–169.
3. Mirabella F. Pericardial mesothelioma. Evolution and update in the last decade (Italian). Pathologica 1993; 85:377–386.
4. Loire R, Tabib A. Malignant mesothelioma of the pericardium. An anatomo-clinical study of 10 cases (French). Arch Mal Coeur Vaiss 1994; 87:255–262.
5. Wagner JC, Sleggs CA, Marchand P. Diffuse pleural mesothelioma and asbestos exposure in the northwestern Cape Province. Br J Ind Med 1960; 17:260–271.
6. Antman KH. Natural history and epidemiology of malignant mesothelioma. Chest 1993; 103 (Suppi 4):373S–376S.
7. Passero MA, Calabresi P. Neoplasms of the mediastinum and the mesothelioma. In: Calabresi P, Schein PS, eds. Medical oncology. New York: McGraw-Hill, 1993; 625–648.
8. Rom WN, Travis WD, Brody AR. Cellular and molecular basis of the asbestos-related diseases. Am Rev Respir Dis 1991; 143:408–422.
9. Hammond EC, Selikof IJ, Seidman H. Asbestos exposure, cigarette smoking and death rates. Ann NY Acad Sci 1979; 330:473–490.
10. Saric M, Vujoviç M. Malignant tumors in an area with an asbestos processing plant. Public Health Rev 1994; 22:293–303.
11. Fischbein A, Luo JC, Pinkston GR. Asbestosis, laryngeal carcinoma, and malignant peritoneal mesothelioma in an insulation worker. Br J Ind Med 1991; 48:338–341.
12. Albin M, Jakobsson K, Attewell R, Johansson L, Welinder H. Mortality and cancer morbidity in cohorts of asbestos cement workers and referents. Br J Ind Med 1990; 47:602–610.
13. Erzen C, Eryilmaz M, Kalyoncu F, Bilir N, Şahin AA, Bariş YI. CT findings in malignant pleural mesothelioma related to nonoccupational exposure to asbestos and fibrous zeolite (eritonite). J Comput Assist Tomogr 1991; 15:256–260.
14. Smith TR. Malignant peritoneal mesothelioma: marked variability of CT findings. Abdom Imag 1994; 19:27–29.
15. Sans N, Cnudde F, Chevallier J, Mathieu S, Giron J, Railhac JJ. A rare peritoneal tumor; malignant mesothelioma (French). Ann Radiol (France) 1993; 36:118–124.
16. Suzuki Y. Diagnostic criteria for human diffuse malignant mesothelioma. Acta Pathol Jpn 1992; 42:767–786.
17. Guest PJ, Reznek RH, Selleslag D, Geraghty R, Slevin M. Peritoneal mesothelioma: the role of computed tomography in diagnosis and follow-up. Clin Radiol 1992; 45:79–84.
18. Weidner N. Malignant mesothelioma of the peritoneum. Ultrastructr Pathol 1991; 15:515–520.
19. Spirtas R, Heineman EF, Bernstein L, Beebe GW, Keehn RJ, Stark A, Harlow BL, Benichou J. Malignant mesothelioma; attributable risk of asbestos exposure. Occup Environ Med 1994; 51:804–811.
20. Leigh J, Rogers AJ, Ferguson DA, Mulder HB, Ackad M, Thompson R. Lung asbestos fiber content and mesothelioma cell type, site and survival. Cancer 1991; 68:135–141.
21. Roggli VL. Malignant mesothelioma and duration of asbestos exposure: correlation with tissue tissue mineral fiber content. Ann Occup Hyg 1995; 39:363–374.
22. Saitoh K, Muto H, Hachiya N, Takizawa Y. Asbestos body and fiber concentrations in pathological autopsy tissues of patients with malignant peritoneal mesothelioma. Bull Environ Contam Toxicol 1993; 50:325–332.
23. Davis JM, Bolton RE, Miller BG, Niven K. Mesothelioma dose response following intraperitoneal injection of mineral fibers. Int J Exp Pathol 1991; 72:263–274.
24. Andrion A, Bosia S, Paoletti L, Feyles E, Lanfranco C, Bellis D, Mollo F. Malignant peritoneal mesothelioma in a 17-year-old boy with evidence of previous exposure to chrysolite and tremolite asbestos. Hum Pathol 1994; 25:617–622.
25. Karjalainen A, Meurman LO, Pukkala E. Four cases of mesothelioma among Finnish anthophyllite miners. Occup Environ Med 1994; 51:212–215.
26. Selçuk ZT, Çöplü L, Emri S, Kalyoncu AF, Şahin AA, Bariş YI. Malignant pleural mesothelioma due to environmental mineral fiber exposure in Turkey. Analysis of 135 cases. Chest 1992; 102:790–796.
27. Şahin AA, Çöplü L, Selçuk ZT, Eryilmaz M, Emri S, Akhan O, Bariş YI. Malignant pleural mesothelioma caused by environmental exposure to asbestos bodies or eronite in rural Turkey: CT findings in 84 patients. Am J Roentgenol 1993; 161:533–537.