

Pathology of Human Malignant Mesothelioma

—Preliminary Analysis of 1,517 Mesothelioma Cases—

Yasunosuke SUZUKI

Division of Environmental Medicine, Department of Community and Preventive Medicine, Mount Sinai School of Medicine, New York, New York, 10029

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Abstract: The author reviewed 1,517 human malignant mesothelioma cases from 1975 through August 2000. These mesothelioma cases were definite or probable in diagnostic certainty. Sources of these cases varied including asbestos insulation workers, UNARCO workers, Cancer and Leukemia B mesothelioma panel cases and random cases. Pathology materials consisted of autopsy, biopsy and rare cytology specimens. 92.3% of these patients were male, and 85.8% were between 50 and 79 years in age. The major primary site of the tumor was the pleura (73.1%). However, in a group of the asbestos insulation workers, the peritoneum was the more common primary site of malignant mesothelioma, compared to the pleura. Histologically, epithelial cell type was the majority (61.1%), followed by biphasic (22.1%) and fibrosarcomatous (16.4%). A double primary tumor (malignant mesothelioma associated with other cancer) was present in 32 of the 1,517 cases. These 32 cancers included lung cancers, renal cell carcinomas, colorectal cancers, pancreatic cancers and a cancer of the larynx, which are known to be at higher risk among asbestos insulation workers. The latency period of the vast majority (98.1%) of these mesothelioma cases were longer than 20 years. It is well accepted that cigarette smoking does not contribute to the induction of malignant mesothelioma. Indeed, the present study confirmed that 19.9% of these mesothelioma patients had never smoked cigarettes.

Key words: Human malignant mesothelioma, Pathology

In 1975, in response to late Dr. Irving J. Selikoff's request, the author initiated a histopathological evaluation of human malignant mesothelioma using autopsy and biopsy samples obtained from deceased asbestos insulation workers. It was a part of his epidemiological study^{1,2)} on a cohort mortality for asbestos insulation workers in the United States and Canada.

Since then, the author has been continuously reviewing mesothelioma cases of various sources including the above insulator's cases and the number of mesothelioma cases reviewed by the author reached over fifteen hundreds in August of 2000. This is a preliminary report on 1,517 malignant mesothelioma cases which were confirmed as definite or probable in the diagnostic certainty by the author, based on systematic analysis³⁻⁵⁾ including gross appearances, histology, histochemistry and electron microscopy (in limited

numbers of cases).

Source of these 1,517 mesothelioma cases varied; it included 436 asbestos insulation workers, 20 UNARCO workers, 225 Cancer and Leukemia B (CALGB) mesothelioma panel cases and 836 random cases (including 9 south-central Turkish mesothelioma cases). It is known that the asbestos insulation workers had been exposed to chrysotile and amosite and that the UNARCO workers had been exclusively exposed to amosite. The Turkish cases were reported to be erionite (a subtype of zeolite) related malignant mesothelioma⁶⁾. In both the CALGB and random cases, patients' occupation varied; shipyard workers, former US Navy servicemen, seamen, pipe fitters, boiler men, electricians, powerhouse workers, sheet metal workers, carpenters and family members of asbestos workers etc.

Pathology materials consisted of 465 autopsy (360 autopsy

Table 1. Age distribution of 1,462 of 1,517 mesothelioma cases

Age	Number (percentage)
< 29 years old	12 (0.8%)
30 to 39	25 (1.7%)
40 to 49	115 (7.9%)
50 to 59	375 (25.6%)
60 to 69	550 (37.6%)
70 to 79	330 (22.6%)
80 to 89	55 (3.8%)

alone and 105 autopsy plus biopsy and or cytology), 1,151 biopsy (1,079 biopsy alone and 72 biopsy and cytology) and 1 of cytology alone. Type of pathology specimen was not known in 9 cases.

Sex was known in 1,515 of the 1,517 cases. Male was the majority (1,399; 92.3%) and female was the minority (116; 7.7%). Age was known in 1,462 of the 1,517 cases (Table 1). As shown in Table 1, 85.8% of these patients were 50 to 79 years old in age.

The site of malignant mesothelioma was known in 1,496 of the 1,517 cases (Table 2). The most common primary site of the tumor was the pleura. The numerical ratio between pleural mesothelioma and peritoneal mesothelioma was approximately 3:1 in the present study. However, it is known that this ratio was reverse in asbestos insulation worker's mesothelioma^{1,2,4,5}. The present study showed that the ratio was 1:2.6 between the pleural and peritoneal mesothelioma among the asbestos insulation workers.

Cell type was clarified in 1,511 of the 1,517 cases. Epithelial cell type was the majority (930; 61.5%), followed by biphasic (334; 22.1%) and fibrosarcomatous (247; 16.4 %).

A double primary tumor was present in 32 of the 1,517 cases. These 32 cancers associated with malignant mesothelioma were 8 lung cancers, 5 renal cell carcinomas, 7 colorectal cancers, 2 pancreatic cancers, 1 larynx cancer, 7 prostate cancers, 1 thyroid cancer and 1 urinary bladder cancer. The author has previously reported four cases of malignant mesothelioma associated with lung cancer among asbestos insulation workers^{7,8}. Among other double primary tumors, renal cell carcinoma, colorectal cancer, larynx cancer and pancreatic cancer are known to be at higher risk among asbestos insulation workers compared with the general population^{1,2}.

Latency period (duration from the first asbestos exposure to death) was clarified in 800 of the 1,517 cases (Table 3). As shown in Table 3, the latency period was longer than 20

Table 2. Site of malignant mesothelioma of 1,496 of 1,517 cases

Site	Number (percentage)
Pleura	1,094 (73.1%)
Peritoneum	355 (23.7%)
Pericardium	5 (0.3%)
Pleura and Peritoneum	33 (2.2%)
Pleura and Pericardium	5 (0.3%)
Pleura, Peritoneum and Pericardium	3 (0.2%)
Peritoneum and Pericardium	1 (0.06%)

Table 3. Latency period of 800 of 1,517 mesothelioma cases

Number of Years	Number (percentage)
11–19 years	15 (1.9%)
20–29	122 (15.2%)
30–39	279 (34.9%)
40–49	260 (32.5%)
50 and over	124 (15.5%)

years in 98.1% of these 800 cases.

Cigarette smoking history was known in 820 of the 1,517 cases. Ex-cigarette smokers were 430 (52.4%), followed by present smokers (227; 27.7%) and non-smokers (163; 19.9%) among the 820 cases. It is generally accepted that cigarette smoking does not contribute to the induction of malignant mesothelioma⁹. The author will continue further analysis of these human malignant mesothelioma cases.

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