H62 Asbestos Fiber Burden in the Lungs of the Deceased From Asbestos-Related Diseases (ARD): An Epidemiological Study and Scanning Microscope/Energy Dispersive Spectroscopy (SEM/EDS) Analysis

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Learning Overview: The goal of this presentation is to investigate a large series of deaths due to ARD, through an extensive epidemiological study and, in a smaller group of individuals, by assessing the fiber burden in the subjects' lungs using SEM/EDS to clarify the role of asbestos in causing human diseases, primarily mesothelioma.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing novel insights regarding the impact of asbestos on human health using biological samples collected during forensic autopsies.

ARDs are often brought to the forensic pathologist's attention due to the high mortality of mesothelioma and lung cancer and to the complex legal implications, related to the responsibility of the manufacturers. Even though the use of asbestos has been banned in the United States, as well as in most European countries, the widespread production and use of asbestos have caused unprecedented human suffering and still represents a major public health problem all over the world. Note that in many countries, the mining and use of asbestos is still allowed (e.g., Canada, Russia, China). The latent onset of disease from exposure has led to a catastrophic epidemic and a continuing onslaught because of people being exposed decades ago. Despite the relationship between asbestos and mesothelioma, lung cancer, and asbestosis being well documented, many issues concerning the etiopathogenesis of ARD, especially mesothelioma, are still debated. For example, the role of fiber type and dimension (length and thickness), the importance of exposure dose, and the dose-response effect are still questioned.

This retrospective study included 188 subjects who died from ARDs (mesothelioma, lung cancer, and asbestosis) during 2000–2017 in the area around Broni, Italy, where an important asbestos cement factory had been active from 1932 until 1993. A forensic autopsy was performed in each case, during which the entire lungs were collected and formalin-fixed. The main objective consisted in analyzing the records, including the clinical files, the autopsy, and the histological report, investigating the type of exposure to asbestos (occupational, neighborhood, household), the survival time since the diagnosis, the latency time, and the relationship to cigarette smoking.

Then, a smaller group was carefully selected, including 40 subjects, subgrouped as follows: ten males who died from mesothelioma and had occupational exposure; ten males who died from mesothelioma and had only neighborhood exposure; ten females who died from mesothelioma and had only neighborhood exposure; and, finally, ten males with occupational exposure who died from asbestosis. For these subgroups, an SEM/EDS analysis was performed on the lung samples collected during the autopsy.[1] The main endpoints consisted in detecting the lung fiber burden, the dimensions, and the mineralogic species of each detected fiber.

The statistical analysis performed on the whole sample showed that there was a significant relationship between the cause of death and the type of exposure. Interesting and significative differences were reported between the different kinds of exposure (occupational, neighborhood, and household) analyzed for the different pathological pictures (mesothelioma, asbestosis, and lung cancer). A significant association was observed between smoke and neighborhood exposure (p=0.026). Moreover, among the mesothelioma patients, the survival time was shorter in the subjects with a neighborhood or household exposure. Regarding the SEM/EDS results, interesting differences, in terms of mineralogic species and fiber dimension, were observed between the four groups.

In conclusion, this study provided interesting and novel data about the role of different doses and types of asbestos in causing human pathologies and its interaction with other factors. The present data appear to support the hypothesis that even an exposure to a very small amount of asbestos (due to, for example, a neighborhood exposure) can cause mesothelioma in hypersusceptible subjects.

Reference(s):

1. Belluso, E., Bellis D., Fornero E., Capella S., Ferraris G., and Coverlizza S. 2006. Assessment of Inorganic Fibre Burden in Biological Samples by Scanning Electron Microscopy–Energy Dispersive Spectroscopy. *Microchimica Acta*, 155 (1): 95–100.

Asbestos, Scanning Electron Microscope, Mesothelioma