

RESEARCH ARTICLE

Reconstruction of asbestos exposure in workers suffering from pleural neoplasms and employed in sectors not generally associated with high exposure levels: the importance of an accurate standardized assessment of occupational medicine

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Keywords

Asbestos • Pleural mesothelioma • Standardized occupational medicine assessment

Summary

Introduction. Malignant pleural mesothelioma onset in workers exposed to asbestos is well known with reference to multiple working sectors. In some cases, occurring among workers of sectors characterized by a presumed lower relevance of asbestos exposure, the absence of a well-defined correlation can prevent their emergence and compensation. To improve definition of these cases, this article underlines the importance of a standardized approach to occupational anamnesis.

Methods. Thorough standardized occupational health assessment method application in a case of pleural malignant neoplasm occurred in a hauler, a job generally not associated with high levels of exposure to asbestos fibres.

Results. Assessment of malignant pleural mesothelioma diagnosis and dual mode relevant occupational exposure to asbestos during both truck driving and loading and unloading operations of asbestos-containing goods.

Conclusions. Systematic occupational medicine assessment with accurate standardized approach is essential for reconstruction of asbestos exposure, in order to highlight every aspect useful to establish causal link between cases of pleural mesothelioma and possible occupational and non-occupational exposure to the mineral, even in cases where the first-level occupational history does not appear to be suggestive.

Introduction

Malignant pleural mesothelioma occurrence among workers exposed to asbestos is a known fact with reference to multiple work sectors. However, in approximately 20% of cases of ascertained pathology it is not possible to identify an exposure to the mineral [1]. This element can determine a considerable obstacle to reporting the occupational origin of the disease and to its compensation. It is considered useful to introduce a systematic specialist occupational medicine assessment already at the time of clinical diagnosis, with the aim of reconstructing in a standardized way the possible occupational and non-occupational exposure to asbestos of patients with pleural mesothelioma.

Methods

This work describes the application of a standardized method of asbestos exposure's reconstruction to the case of a worker with pleural mesothelioma who requested occupational medicine assessment due to unsatisfactory initial etiological classification.

Worker's clinical history was reconstructed analysing health records relating to the diagnosis of neoplastic pathology, carried out by radiological tests, cytological examination on liquid taken during bronchoscopy and evacuative thoracentesis and histological examination conducted on tissues taken during thoracoscopy, performed to complete the necessary chemical pleurodesis procedure, and during autopsy. Occupational history was conducted by direct administration of a standardized questionnaire to the patient [2]. The questionnaire consists of several sections investigating several areas of interest: general information on the patient; smoking habit; physiological and pathological history; general information on the work activities; family history; environmental life context; evaluation of the reliability of the answers; professional in-depth history, with specific items for different work sectors; description of any activity carried out during military service; history of extra-occupational context.

Results

A 73-year-old male subject, resident in a municipality in the province of Venice, was visited in June 2018. Clinical

history was negative for previous neoplastic pathologies, and showed: atrial fibrillation in pharmacological treatment, Hashimoto's thyroiditis in spontaneous euthyroidism, leukopenia, thrombocytopenia, and prostatic hypertrophy. No previous thoracic trauma, pleurisy or radiotherapy have been reported.

The clinical onset dates back to April 2018 with appearance of wheezing dyspnoea, left thoracalgia and a persistent cough. During hospitalization, a chest X-ray showed: "Extended pleural effusion almost completely occupies the left pulmonary field with relative saving of the upper lobe. The right pulmonary field is normal and transparent. Right hilar shadow and right heart profile within limits. No pleural flaps on that side". Thorax CT scan with contrast medium showed: "Abundant pleural fluid effusion is evident in the left hemithorax, most evident at the base where it reaches an AP thickness of 70 mm. Recognizable atelectasis of most of the lower lobe with relative saving only of the lateral basal segment. Some pleural thickenings are present, in part calcific marginal on the right. Coarse plaques of pleural thickening largely calcified, the largest of 12 mm, are evident in the left diaphragmatic area. Some pleural plaques partly calcified in the left posterior costophrenic sinus and along the marginal ridge in the middle third of the left". Cytological examination of liquid taken during bronchoscopy showed: "Amorphous and blood material comprising macrophages, neutrophils, activated mesothelium and elements with nucleocytoplasmic atypia of suspected neoplastic nature". Cytological examination of liquid taken during thoracentesis showed: "Aggregates of cells with fusiform morphology in myxoid matrix. The cytological picture orientates for malignant mesenchymal neoplasia". The patient was then subjected to thoracoscopy and chemical pleurodesis surgery on the left. The histological examination carried out on biopsy samples collected during the intervention highlighted: "Fragments of parietal pleura with localization of epithelioid mesothelioma with pattern of trabecular growth; present hyaline plaques and inflammatory infiltrates; striated muscle tissue where undamaged; immunohistochemical analysis: calretinin+; WT1+; cytokeratin 5/6+, CEA-, BerEp4-, Ttf1-". Abdomen CT scan with contrast medium showed no signs of neofomations affecting the abdominal organs, nor the abdominal wall and its appendages. The only abnormal finding was a 25 mm diameter cyst on the left renal pole. The patient underwent cancer chemotherapy and died in August 2018 of cancer cachexia. The histological examination performed on the lungs taken during autopsy revealed "Fragment of pleura with extensive scleroyalinosi in contiguity with peritoneal fragment with diffuse mesotheliomatous epithelioid infiltration (calretinin+, MNF116+, AE1/AE3+, Podoplanin+/-, TTF1-). Left lung fragments with scleroyaline pleural plaques and epithelioid mesotheliomatous infiltration. Left and right lung parenchyma with emphysema, congestion, modest interstitial fibrosis, asbestos corpuscle count with Perls method gave negative results. Diagnosis: pleural mesothelioma epithelioid with peritoneal extension".

Reconstruction of exposure to asbestos fibres was carried out by directly administering the standardized questionnaire indicated by the ReNaM as a useful tool to substantiate the possible occupational and non-occupational exposures to the mineral [3]. The patient has also provided testimonial statements signed by co-workers concerning the way in which the assigned job duties were performed. From the occupational anamnesis the patient appears to have worked:

- from 1960 to 1965 and from 1967 to 1973 as a farmer at the family farm;
- in 1966 he served as a conscript with the armed forces;
- from 1966 to 1972 and from 1972 to 1998 as a hauler for two trucking companies in Venice.

Between 1966 and 1988 he drove FIAT brand trucks, models 682, 619 and 190/35; between 1972 and 1998 FIAT brand trucks, models 619, 190/35, 190 Turbostar and Mercedes-Benz brand, model Actros. During the activity of hauler, the worker systematically carried out loading, unloading and transport of different types of materials made of or containing asbestos: dust, flakes, slabs, pipes, fireproof clothing, gaskets, flanges, panels, corrugated sheets and flat plates. Asbestos or asbestos-containing materials were frequently contained in jute bags until the late 1970s of the last century. In fact, he transported these goods between Marghera's port and several companies in Northern Italy where asbestos was processed to produce different types of objects. The operations of loading and unloading of materials, both at Marghera's port and at the companies, were manually carried out directly by the worker, even inside warehouses and other enclosed places, always in absence of collective or individual protection devices. He also made some repairs by accessing the truck's engine compartment in case of some breakdowns along the way, as well as minor routine engine maintenance. He did not report maintenance operations on the braking system, although reporting several replacements of punctured tires. No suggestive elements emerged due to exposure to asbestos during farmer activity or during military service. Regarding any extra-occupational exposure to asbestos fibres, no relevant data emerged in relation to residence or extra-work activities. The patient had begun the activity of hauler at the age of about 21 years. At time of the diagnosis of malignant pleural mesothelioma he had turned 73 years old. The latency was 52 years. Based on the elements obtained from pathological anamnesis, occupational anamnesis and the assessment of exposure to asbestos fibres, it has been possible to identify the existence of a plausible causal link between occupational exposure to the mineral and the pleural neoplasm.

Standardized occupational anamnesis has in fact allowed to highlight a dual mode of occupational exposure to asbestos: one relating to the activity of portage and handling of goods and another one relating to the activity of hauler, generally considered as characterized by a non-significant exposure to asbestos. The standardized approach has therefore allowed to highlight not only the existence of a significant occupational exposure to

asbestos in the activity of the patient under examination but also to highlight how this was attributable to different aspects of the activity itself.

Therefore the first certificate of occupational disease was compiled, reports were prepared for the competent Authorities (according to the provisions of art. 365 of the Criminal Code) and to the National Institute for Insurance against Accidents at Work (INAIL) for epidemiological and statistical purposes (according to the provisions of Article 139 of Presidential Decree 1124/1965 and Legislative Decree 38/2000). The pathology has been recognized as caused by occupational exposure to asbestos.

Discussion

The clinical case of malignant pleural mesothelioma occurred in a 73-year-old subject at the time of diagnosis. The patient requested on his own initiative an occupational medicine assessment, believing that the etiological classification carried out in the hospital ward at the time of clinical diagnosis was not exhaustive. The age at which the subject started working involving exposure to asbestos was 21 years and latency was 52 years. These parameters are included in the respective intervals reported in the VI ReNaM Report in relation to the operating sectors of land transport and portage activities. In Italy, the National Mesothelioma Registry (ReNaM) periodically publishes a report in which the epidemiological information relating to mesothelioma cases arising in asbestos-exposed workers in different work sectors [1]. ReNaM's periodic reports, an epidemiological surveillance tool, can be a useful support for occupational health professionals involved in the correct attribution of asbestos exposure. Only few cases of pleural mesothelioma among transport workers have been reported [3, 4]. In addition, data published in ReNaM's latest report, in the section with the tables of the tasks involved in asbestos exposure by category of economic activity, in the maritime and air transport category indicates 134 cases of pleural mesothelioma recorded in the national register among drivers of heavy vehicles and trucks from 1993 to 2015 [1].

Diagnostic elements inferred from the outcome of health checks satisfied the requirements for diagnosis of malignant pleural mesothelioma as reported in the Sixth ReNaM Report [1]. Similarly, elements deriving from the standardized questionnaire allowed to include the case into the category of certain occupational exposure. With reference to the trucks normally used by the worker, FIAT 682 model is one of those in which the presence of asbestos has been documented. The mineral was found to be present in the vehicle in several parts and with different characteristics. In fact, it was found in form of a cord wrapped around the exhaust manifold. Asbestos fibers were found inside the driver's cab of this truck, in relation to the position of the chassis itself [5]. Authors of that work described a case of asbestosis in a

person who had been a hauler all his life, without ever having transported asbestos material or having carried out maintenance of the vehicles, and for which other expositive sources were not detectable extra-professional asbestos.

Another published clinical case is about a hauler who developed malignant pleural mesothelioma related to a short duration but high-level chrysotile working exposure during operations of loading and unloading of the vehicle over a period of a few months at an asbestos quarry. The authors of that work pointed out the plausibility of an exposure to the mineral even in an employment – that of the truck driver – usually not associated with high exposures [4].

It was also reported a case of malignant pleural mesothelioma that occurred in a hauler that for 30 years had driven trucks known in literature for contamination of the cockpit with asbestos fibre, without ever having transported asbestos materials or mediated maintenance of vehicles in the absence of extra-working mineral exposures [3]. That clinical case therefore highlighted the plausibility of the attribution of a case of pleural mesothelioma to exposure to asbestos deriving from the sole activity of driving trucks made with components able to release mineral fibre inside the driver's cab, in the absence of other exposure modes.

The work history described in this case report highlights a possible exposure of the worker to asbestos fibres in relation to the mechanical maintenance operations of the truck and the handling of objects made of or containing asbestos. The former involved accessing the engine compartment, disassembling, cleaning, repairing or replacing and reassembling different types of mechanical components. The handling operations of the transported goods were carried out in purely manual mode by the worker. He loaded the asbestos products or raw materials contained in jute bags onto the truck and unloaded them once they reached their destination. During these phases, especially with reference to the asbestos contained in bags, the dispersion of the material could be frequent with consequent possibility of inhalation by the worker, facilitated by the unavailability of individual devices to protect the respiratory tract. The bags could break easily, releasing large quantities of fibres also because they did not benefit from any special treatment but were treated like any other commodity.

The case of malignant pleural mesothelioma described in the present work presents a double mode of occupational exposure to asbestos fibre: a first one deriving from the direct manipulation of asbestos materials during the loading and unloading phases, and a second one deriving from the breathing of the mineral inside the cab also in relation to the maintenance operations carried out inside the engine compartment.

The description of this case underlines the importance of an in-depth and accurate standardized approach in the reconstruction of exposure, both occupational and non-occupational, to asbestos in order to highlight every aspect useful for the reconstruction of the causal link

between pleural mesothelioma cases and the possible opportunities of exposure to the mineral. With these aims, it is therefore important to subject cases of neoplastic diseases attributable to asbestos to occupational medicine assessment already at the time of clinical diagnosis, even when a first-level occupational anamnesis appears not to be relevant with reference to asbestos.

Conclusions

The described clinical case shows that standardized approach makes it possible to accurately determine possible scenarios of asbestos exposure even in cases for which a first-level occupational history is not suggestive. An occupational medicine assessment is advisable for all cases of neoplasms attributable to asbestos exposure, already at time of clinical diagnosis, in order to properly undertake the procedure for reporting and compensation for occupational disease.

Acknowledgements

Funding sources: this research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflicts of interest statement

The authors declare no conflict of interest.

Authors' contributions

Author performed interview with patient, questionnaire administration, literature research and paper writing.

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Received on June 23, 2019. Accepted on January 25, 2021.

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How to cite this article: Scopa P. Reconstruction of asbestos exposure in workers suffering from pleural neoplasms and employed in sectors not generally associated with high exposure levels: the importance of an accurate standardized assessment of occupational medicine. *J Prev Med Hyg* 2021;62:E148-E151. <https://doi.org/10.15167/2421-4248/jpmh2021.62.1.1334>

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