Focus on the Asbestos-Related Diseases in a Pulmonology Department

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Romania implemented the complete asbestos ban legislation in 2004. Like in other countries, it would be expected that asbestos-related diseases (ARD) to reaching their peak in the following years. In this study, we present the characteristics of ARD among patients admitted in the Clinical Pneumophthisiology Hospital of Constanta, Romania, during 3 years: 2015 - 2017). Previous industrial asbestos exposure in Medgidia, a town situated in Constana County, was one of the highest in Romania, but the number of ARD cases remained relatively small. This situation demands a better investigation and surveillance of all previously exposed employees based on a comprehensive occupational history and a better collaboration with the occupational health specialists.

Keywords: asbestos, asbestosis, mesothelioma

Asbestos is defined as a group of mineral fibers with very good properties to be used in lots of fields such as construction, automobile, and shipbuilding industry as a cheap, insulating material, with high resistance to heat and combustion (up to 100 degrees C) [1-3]. It includes the following fibrous silicates with different toxicity: asbestos actinolite: $Ca_2(MgFe)_5(Si_8O_{22})(OH)_2$; asbestos grunerite (amosite-brown asbestos: $(FeMg)_7(Si_8O_{22})(OH)_2$; asbestos anthophyllite: $(MgFe)_7Si_8O_{22}(OH)_2$; chrysotile (white asbestos: $Mg_3(Si_2O_5)(OH)_4$); crocidolite (blue asbestos: $Na_2Fe_5(Si_8O_{22})(OH)_2$, asbestos tremolite $(Ca_2Mg_5(Si_8O_{22})(OH)_2)$ [4]. The deep inhalation into the lungs of these asbestos fibres is responsible for severe chest asbestos-related diseases (ARD) such as asbestosis, mesothelioma and lung carcinoma. The data reveals that crocidolite is more dangerous than other types of asbestos fibres [4,5]. 98% of the crocidolite production was used to produce corrugated asbestos roofing boards, generating the maximal exposure aside production areas to the construction workers [2,3]. Chrysotile is also known as a risk factor for the occurrence of pleural and peritoneum mesothelioma even its impact is considered less 2-4 times carcinogenic than crocidolite [6,7]. Because of the long period of time between exposure and any detectable signs of ARD by current screening methods, the rate is continuously growing, even though asbestos has been completely banned from occupational settings for more than a decade [8]. The official recognition of occupational diseases varies from country to country, according to the surveillance system on the site and the criteria used for compensation. For example, in Germany, during 2013-2016, the number of mesothelioma remained stable, around 1400 new cases/year, of which, 80% were acknowledged as occupational, while lung cancer in patients previously exposed to asbestos was overall lower (around 130 new cases/year), and the compensation, involving the lung fibre counts on the histological samples, was only recognized for 20% of them [9]. The environmental asbestos past exposure in Romania is mostly related to the mining industry in Banat area and construction materials production in Gorj and Constanta counties [10]. Cases are expected to increase in the following years and physicians should be alerted to the new topics of asbestos- related diseases especially cancer. As the Tertiary Care Clinical Pneumophtisiology Hospital is receiving patients from the whole region of Constanta county, including a previously heavily polluted area (Medgidia town), the aim was to assess the characteristics of ARD in patients with environmental and occupational asbestos exposure.

Experimental part

The study was aimed to answer the following questions: What cases of pulmonary pathology could be related to the past asbestos expose and what is the prevalence of asbestos related diseases (ARD) among inpatients of Constanta Clinical Pneumophtisiology Hospital, Romania? The primary objective of the study was to overcome the in-hospital-related morbidity caused by asbestos exposure in a county tertiary care hospital with a Pulmonology profile. A three - year study retrospective survey of ARD, based on electronic records and medical files, was performed from January 2015 to December 2017. A total number of 8,914 patients were admitted and 22 cases were registered with a personal history of asbestos exposure. Occupational exposure time and asbestos fibres retention time were questioned. Exposure to asbestos fibres was classified in occupational, environmental and indoor. Life time tobacco exposure was evaluated by history of pack-years of cigarette smoking. Demographics, clinical, radiological, functional and histopathologic features were collected and all associated risk factors were assessed. Cases were divided into group 1 with malignant ARD including mesothelioma and lung cancer and group 2 with benignant pleural and lung parenchymal involvement as pleural effusions, pleural plaques with or without calcifications, localized or extensive scarring or thickening, round atelectasis, lung fibrosis. Statistical analysis was performed by EPI INFO version 7 and SPSS version 19th.

Results and discutions

From 2015 to 2017, 22 cases of 8,914 inpatients were diagnosed with ARD (Table 1). The overall in-hospital morbidity of pleural and lung diseases caused by exposure to asbestos was low (n=22/8,914; 0.24%). The study group included 13 males (59%) and 9 females (41%), 14 active smokers, 1 former smoker and 7 never smokers. Occupational exposure was considered in only 8 cases

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(36.36%). Environmental exposure was identified in 40.9% patients (n=9/22) living in Medgidia town, in the proximity of the old factory of asbestos and cement production, within a diameter of ≤ 30 km distance. Medgidia town is known for its cement plant, one of the sources of asbestos, where crocidolite is one of the components of the technological process. All others (n=5) had indoor exposure or own building activities. Anova analysis revealed no difference between males and females regarding age (62.77 years +/-12.236 std. dev. versus 60.67 years +/- 7.483 std. dev.; F= 0.184; p= 0.672), body mass index (25.346 kg/m^2 +/- 5.310 std.dev. versus 25.356 kg/m^2 +/- 5.320 std. dev.; F= 0.000; p= 0.997), pack-years of smoked cigarettes (35.75 +/- 14.548 std.dev. versus 26.5 +/- 19.847 std.dev.; F=1.020; p= 0.332), occupational exposure time (23.48 years +/- 7.981 std.dev. versus 19.83 years +/- 10.852 std.dev.; F=0.663; p= 0.430) or asbestos fibres retention time (41.67 years +/- 10.00 std.dev. versus 34.33 years +/- 12.356 std.dev.; F= 1.610; p= 0.227).

14 patients (group 1) were diagnosed with malignant ARD: 11 of them with malignant pleural mesothelioma (MPM) and 3- with non-small cellular lung cancers (NSCLC). The spectrum of benign asbestos-related illness, diagnosed in 8 patients (group 2), was classified into lung fibrosis (n=10), pleural calcified plaques (n=2), pleural effusions (n=5) and diffuse pleural thickening (n=7). Anova analysis revealed no difference between group 1 and group 2, regarding the mean of pack years smoking [35.56 +/-12.866 std. dev. (limits: 20-51) versus 25.00 +/- 22.705 std. dev. (limits: 5- 60); F= 1.269; p= 0.282], the mean time of asbestos exposure [21.75 years +/-9.161 std. dev. (limits: 2- 30) versus 22.71 years +/- 9.690 std. dev. (limits: 7-33); F= 0.039; p= 0.846] and retention of asbestos fibers [37.29 years +/-10.420 std. dev. (limits: 24-50) versus 40.00 years +/- 12.41 std. dev. (limits:20-57); F= 0.207; p= 0.657].

Occupational exposure was documented in almost a half of patients diagnosed with MPM (n=5/11; 45.45%), all being employees of the Medgidia cement industry and acknowledging exposure to asbestos with a mean time of 21.2 years +/- 11.541 std.dev (limits: 2-30 years) and a longer latency of symptoms revealed by an increased mean of asbestos fibres retention time (33.20 years +/-12.112 std.dev; limits: 21-50). The rest of cases reported either environmental or indoor home (building construction by asbestos and cement). In addition to the asbestos exposure, other risk factors of MPM such as smoking (45.45%), personal history of cancer (one case of osteosarcoma) and familial positive history of cancer (18.18%) were identified, sustaining the hypothesis that the genetic predisposition for mesothelioma exists. The two familial MPM cases were diagnosed at 1.5 years difference from each other among sisters living at approximately 2 km away from the factory, with an environmental source of asbestos exposure [1]. According to a Sweden study, there is an increased risk of 3.9% to 12.4% among the relatives of those diagnosed with malignant mesothelioma [11]. Characteristic symptoms of the onset were persistent diffuse chest pain (71.4%) and mild to moderate dyspnoea (90%). 61% of patients experienced comorbidities, especially those in group 2, with benign disease. The most common were cardiovascular comorbidities (blood hypertension, ischemic heart disease) (n=8), obstructive lung disease (COPD, asthma) (n=11) and chronic respiratory failure (n=2) in group 1. All the benign forms of asbestosis were accidentally discovered during investigations for other conditions. Thorax CT scan has a central role in the diagnosis of asbestos-related illnesses. The histopathologic exam for the confirmation of ARD diagnosis is mandatory. Immunohistochemistry is recommended because of possible confusion between MPM and malignant pleural effusion (MPE) caused by lung adenocarcinoma [12]. One of the patients with MPM was firstly diagnosed with lung cancer adenocarcinoma. Unexpectedly, the pulmonary function test revealed equally the presence of both restrictive dysfunction and obstructive ones, mostly in smokers and COPD patients (n=7). The risk of malignant ARD was increased in both males (n=8/13; 61.5%) and females (n=6/9; 66.6%), increasing with age, as Robinson study revealed [13]. The mortality rate was 45.4% (n=10/22). All death events were registered in group 1 with malignancies (n=10/14; 71.4%) compared to none death in group 2. The extremely severe prognosis of malignant mesotheliomas with survival of approximately 1-2 years is known [2]. Medical professionals are aware about the health risk of workers exposed to air pollutants, showing an increased respiratory symptoms and frequency of occupational diseases especially COPD, asthma and cancer [12-18]. In the last 20 years, since 2005/2006, important European and national legislative measures are available regarding the protection of workers from the risk of respiratory exposure including asbestos and strict limit activities involving exposure to asbestos. Taking into account that all of the cement factories from Romania were modernized and the asbestos was excluded from the technological process, it can be argued that today this kind of pollution on employees is absent. The anamnesis of every patient needs to include the place of work, activities and processes he/she is involved in, the type and quantities of the asbestos used, duration of work per day and seniority in work [19]. Not all the fibres are dangerous. The most important are fibres that need to be measured in the air, which measure a length of more than 5 micrometers, a diameter of less than 3 micrometers and a length/breadth ratio greater than 3:1 [19,20]. The risk of asbestos disease is expressed in terms of cumulative exposure (fibers number / cm^3 x years), respectively as the product of the average asbestos concentration at work (fibers> 5μm in length and <3 μm in diameter) and the number of years exposure to this concentration [2,3] The European Directive, The Occupational Safety and Health

Year	2015	2016	2017	Total
No. of hospital admissions	3,044	2,965	2,905	8,914
Total cases of chest ARD* (No; %)	5; 0.16%	10; 0.33%	7; 0.20%	22; 0.24%
Patients with chest malignant ARD* (No; %)	4	6	5	15
Patients with chest benign ARD* (No; %)	1	4	2	7

*Legend: *ARD= asbestos related diseases*

Table 1
ANNUALLY DISTRIBUTION OF ARD CASES COMPARE TO TOTAL HOSPITAL ADMISSION; 2015-2017

Administration (OSHA) and Romanian regulations established as the standard acceptable exposure - 0.1 fibres/mL of air to fibres longer than 5 micrometers [4]. Asbestos occupational exposure was documented in 21.42% (n=3/14) of malignant pleural mesothelioma (MPM), less than those found by others [1]. Therefore, in our days, the risk of developing ARD is hard to quantify because the outdoor and indoor exposure is neither known nor measured. The asbestos fibres are virtually indestructible, being resistant to heat, and physical and chemical agents (dimensions and durability) [1,2]. We focused on the inhabitants from Medgidia area and our study revealed that environmental exposure had a great importance in developing MPM. The latency period between exposure and the development of different ARD symptoms could be long and variable within patients. Most cases appear after 15 years [21], even longer latent period for the onset of mesothelioma (30-45 years) [22]. The history of inhaled amount, type of fibres and body's ability to remove asbestos fibres is not known in many cases, the difficulty of an accurate differential histologic diagnosis between mesothelioma and lung cancer [11] malignancies require a different clinical management and have reserved prognosis. It is important to emphasize the potential exposure in the construction activities, particularly in demolition of buildings containing asbestos. The interference of smoking and other industrial hazards, such as chemicals or nanoparticles, can increase the unfavourable impact on health status [23]. In this respect, a map of these buildings should be available in order to take all the necessary measures to prevent future exposure to asbestos and smoking cessation must be implemented for a better health [24,25]. Considering smoking a main risk factor both for lung cancer and mesothelioma, education against active and passive smoking has to be permanently and early disseminated in population by all categories of health promoters (medicine students, physicians, nurses, and organizations with specialization in the field).

Conclusions

The identification of cases of lung disease related to asbestos exposure may raise two issues and challenges: either exposure is unknown or it is ignored for a prolonged time. Identifying a small number of cases may not support the need of screening the inhabitants of Medgidia area. Medical education measures and surveillance of previous workers, known to be exposed to asbestos fibers, are mandatory. Delayed discovery of ARD malignant entities is related with a higher risk of death. The impact of environmental or occupational exposure is difficult to estimate and even more difficult is to assess the monitoring of the industrial facilities. For this reason, interdisciplinary approach with the occupational health specialist is mandatory.

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