PULMONARY DUST DISEASES IN BULGARIA

Elisaveta Petrova*

ACC Tokuda Medical Center, Acibadem City Clinic Tokuda Hospital, Sofia, Bulgaria

Abstract. The aim of the study was to present the epidemiological characteristics, new diagnostics trends and prevention of the pulmonary diseases related to dust (PDD) in Bulgaria. Retrospective epidemiological study during the period 1980-2003 y. was done. A new cross sectional case control study of workers exposed to high concentration mineral dust and non-exposed control group in 2003 year were performed. Non parametric, correlation analysis and linear statistical analysis were performed. An SPSS statistical package was used. Epidemiological trends of different types of pneumoconiosis, and 11 years study of tendencies in malignant mesothelioma in the country were analyzed. A prognosis of the appearance of PDD during the future 10 – 30 years was done. A comparison between chest radiographic images and HRCT amongst pneumoconiotic patients was done. Image/functional constellations for diagnostic purposes were created. The following conclusions can be made: 1. PDD play a leading epidemiological role amongst occupational diseases in Bulgaria. 2. An appearance of pneumoconiosis and asbestos-related malignant mesothelioma in the next 10 – 20 years was expected. 3. HRCT, as well as constellation HRCT/VC, FVC and FEF50% could be more correct diagnostic methods in pneumoconioses.

Key words: Epidemiology, dust diseases, chest radiography, chest HRCT, spirometry parameters, constellations

1. INTRODUCTION

Most authors consider that the problems with the diagnosis and the treatment of pneumoconioses in the world have been fully or partially solved in the 20th century [1 and 3]. In the critical review of D. Sherson [7] and in the paper of d’ Mannetje et al. [2] the problems of silicosis were discussed with a look to the 21st century. The neglect of the quartz exposure and silicosis incidence was categorically rejected, and a new dose of quartz exposure and response of human organism was accepted [5]. D. Sherson [7] has presented new data on the relationship between silica exposure, tuberculosis mycobacteria and COPD.

2. AIM

The aim of this paper is to present the epidemiological trends, as well as new diagnostics methods, and the prevention of professional dust diseases [PDD] in Bulgaria during the period from 1980 to 2003.

3. STAGING, MATERIALS AND METHODS

We have performed a retrospective study of workers exposed to non-organic dusts who had worked in underground and overground dust productions in the past. Additionally, a screening in 721 workers was performed in 2003. A subject of the screening were 600 workers, exposed to high concentrations mineral dust: 116 miners from Bobov dol mine, 53 - from Antra, 113 from Balkan 2000 mine, 198 from Lucky, Gorubso mine, 120 asbestos exposed workers, and 121 unexposed administrative staff. We have done a chest high resolution computed tomography [CHRCT] in 81 quartz exposed workers and workers with borderline or initial forms of silicosis. Parallelly, conventional chest radiography [CCR] and spirometry of all exposed and unexposed workers and of patients with pneumoconioses were done. A comparison between the images from CCR and CHRCT was made. Nonparametric, correlation and linear regression analysis using SPSS statistical package were performed. Constellations between image and functional changes by using linear regression analysis were done. We have used a retrospective report from “Cancer Incidence in Bulgaria” for the period 1990 – 2000.

4. RESULTS AND DISCUSSIONS

Trends in the total number of silicosis and silicotuberculosis (upper blue part), silicosis (middle green line) and silicotuberculosis (bottom purple line) in Bulgaria for the period 1985-2000 are shown in Fig. 1. There is a phenomenon of exhaustion of the late forms of silicosis caused by work of dry or dry and water drilling in the mines in Bulgaria. The number of silicoses is decreasing for the period from 1985 to 2000. The total number of the silicoses in 2000 year was 3900, and resp. 900 silicotuberculosises. The total number of asbestos and asbestos pleural plaques and

* mdepetrova@yahoo.com
fibrosis was low. There were 199 persons with asbestos related diseases in 2000. The low detectability was found. The number of silicosis, talcosis, kaolinosis, mixed mineral pneumoconiosis, etc. was low and unchanged from 1995 up to 2000. This trend of low detectability of dust diseases is related to lack of enough knowledge among physicians in this medical field, as well as due to administrative changes after 1989 y. The number of patients with welders’ pneumoconiosis was slightly increased by 1990 – 2000, but their total number [145 persons in 2000] was low. The number of patients with chronic bronchitis was increased, but their total number was relatively low [1250 persons in 2000].

A tendency of increase of peritoneal and pleural malignant mesothelioma in Bulgaria for an 11-year period, with an unclear picture for difficult and the rarely diagnosed pericardial mesothelioma was found [Fig. 2]. According to the Helsinki Consensus, 80% of malignant mesotheliomas are asbestos-based. The increase of cases with malignant mesothelioma in this period is due to the reaching 30-40 years latent period since 1970 years when has registered a peak in the asbestos use in Bulgaria. Newly diagnosed nodular pneumoconioses in basic underground mines and among asbestos exposed workers in 2003 year were shown in Fig. 3. We have found 20 patients with initial silicosis, and pneumoconiosis, related to dust containing quartz in Bobov dol, Balkan 2000, Antra and among workers working with insulations activities in heat electric power production in 2003 [Fig. 3]. Most intensive pleural plaques and fibrosis among workers from ferodo production, KCM “Plovdiv” as well as amongst workers in TPP “Bobov dol” [P<0.05] were found – Fig. 4. We have detected 43 patients with manifest forms of asbestosis [among fitters in heat electric power production, and among welders in ferodo production, all of them with 16 years average dust exposure duration and 17 years average latency from the beginning of work exposure up to the date of the study] – Fig. 4. We have detected 90, resp. 116 workers with “borderline pneumoconiosis” p1/0 – p0/1 type, and 36, resp. 30 with “borderline asbestosis” s0/1 – s1/2 and to/1 – t1/2 type.

![Figure 1. Total number of silicosis and silicotuberculosis during 1985-2000 period](https://example.com/figure1.png)

![Figure 2. Trends in the incidence of malignant mesothelioma of the pleura, peritoneum and pericardium in Bulgaria (by years) for the period 1990-2000](https://example.com/figure2.png)

![Figure 3. Newly diagnosed dust diseases in the main dust production in Bulgaria in 2003” (Nested case control study)](https://example.com/figure3.png)

![Figure 4. Newly diagnosed asbestos related dust lung diseases in 2003 (Nested case control study)](https://example.com/figure4.png)

We have diagnosed most intensive chronic bronchitis amongst miners from Bobov dol mine, where total dust concentrations have been 10 times above the permissible level. The presence of chronic bronchitis was high among miners in the Luky mine, followed by the unexposed control group, miners from Balkan 2000, miners from the Antra mine, and asbestos exposed individuals [P<0.0001] as well [Fig 5]. In case of absence of pneumoconiosis and other non-occupational risk factors, as tobacco smoking etc, the chronic bronchitis among miners in Bobov dol might be considered as occupational, caused by dust. Diagnostic value of the chest high resolution computed tomography [CHRCT] in silicosis cases was evaluated by classification of Kraus et al [4]. The mean density of p small round opacities was higher on CHRCT amongst workers, endangered of silicosis, as well as amongst patients with borderline silicosis – on the one side, in comparison to the mean density of the p small round opacities on the conventional chest radiography [CCR] – on the other side. This finding correspond with opinion of other authors, who have identified more expressed pathologically proven minimal interstitial silicosis with CHRCT compared to CCR [6]. The correlation between the two diagnostic methods for the assessment of the mean perfusion of p small round opacities was significant [R=0.36337; P<0.001].

Progressive massive fibrosis [PMF] was more frequent finding by CHRCT [in 8 patients] than by CCR [in 1 patient]. We have established that CHRCT
visualizes bullous emphysema, intrapulmonary calcifications and calcifications in hilar lymph nodes more precisely than similar findings detected by the conventional chest radiography [CCR].

Conglomerate shadows [ax] in lung parenchyma are more common on CCR because some of them pass into progressive massive fibrosis [PMF] on CHRCT. CHRCT images in pneumoconiosis, caused by dust containing asbestos, were clearer. The frequency and the density of the small irregular opacities [s/u] were higher on CCR, than on CHRCT. In pneumoconiosis, caused by asbestos, CHRCT was the most effective image method for the detection of subpleural fibrosis [in 58.8% of patients]. A correlation between functional pulmonary impairments and CHRCT findings in silicosis patients [diagnostic constellation] was found. A linear regression analysis for the forced expiratory volume for 1 second [FEV1] in silicosis patients has showed a significant negative correlation with PMC from CHRCT. A negative correlation of the peak expiratory flow rate [PEF] and PMF [from CHRCT], and a weak negative correlation of age of silicosis patients was proved. A negative correlation between the forced expiratory flow rate at 50% [FEF50%] and PMF (from CHRCT), as well as between FEF50% and the combination of PMF [from CHRCT] and the age under the dominating role of the PMF were proved. The obstruction of the small airways has been correlated with PMF [on CHRCT] as well as with age. Mean values of vital capacity [VC] and forced vital capacity [FVC] were increased with the appearance of p0/1 small round opacities. With the increasing of density of p small round opacities, there was a parabolic decrease in VC. The decrease of FEF50% in dust exposed workers with proven emphymema was related to the reduction and disappearance of small bronchial branches.

5. CONCLUSIONS

1. We established a tendency for drop in silicosis related to the exhaustion of the late forms of silicosis until 2000. Rarely diagnosed pneumoconioses were silicosis, asbestosis, silicatosis, welder’s pneumoconiosis and others.

2. Newly diagnosed dust diseases in main industries in Bulgaria in 2003 were: initial p1/1 pneumoconiosis due to quartz exposure in Balkan 2000, followed by pneumoconiosis among miners in the Bobov dol mine, as well as among workers exposed to quartz and asbestos containing dust, and workers in the Antra mine.

3. Borderline pneumoconioses p0/1 and p1/0 in Lucky and mine “Balkan 2000” were predominating.

4. Manifest forms of asbestosis amongst workers from the TEZ “Bobov dol” thermal power plant, followed by workers in the non-ferrous metal plant and ferodo production were predominating. The borderline asbestoses cases were with similar distribution.

5. A negative correlation between baseline spirometric functional parameters and images from CHRCT allows us to develop functional/imaging diagnostic constellations, recommended in early diagnostics of silicosis and other nodular pneumoconioses.

6. CHRCT is a more informative method for imaging of progressive massive fibrosis and for additional imaging compared to conventional chest radiography. This makes CHRCT the first-choice method in difficult diagnostic cases and in single cases – for correct and early diagnosis of pneumoconioses.

REFERENCES


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