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RELATIONSHIP BETWEEN IMPAIRMENTS OF FEF50% AND LUNG EMPHYSEMA AMONG WORKERS EXPOSED TO MINERAL DUSTS

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Abstract. *The aim of the study is to analyze the relationship between the decreases of FEF50% – on the one hand, and radiologically verified compensatory lung emphysema among workers, exposed to mineral dust at the work place – on the other. A case control study among 480 quartz-exposed underground miners, 120 asbestos-exposed workers, and 121 individuals without dust exposure was performed. The average age of the examined workers was 42.82 years, and the average duration of the dust exposure was 14.01 years. A clinical examination, as well as a chest radiography (by ILO'80), and spyrometry of all persons were done. We used SPSS software and one-way ANOVA. There was a significant decrease of the mean of FEF50% in cases with lung emphysema, accounted on the chest radiography (by ILO'80). We assume that the compensatory emphysema and reduction of FEF50% is associated with the formation of initial interstitial pulmonary fibrosis among workers exposed to mineral dust over a long period and in patients with pneumoconiosis. Conclusion 1 – The decrease of FEF50% is related to radiologically-established compensatory lung emphysema. Conclusion 2 – The investigation of FEF50%, combined with chest X-ray, is an appropriate constellation for periodical preventive medical check ups and assessment of health status for workers exposed to mineral dust.*

***Key words*:** *Mineral dust exposure, chest radiography, emphysema, FEF 50%*

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1. INTRODUCTION

The views of different authors for changes in the respiratory function among patients with silicosis vary. A part of the publications reports for lack of functional impairments in patients with initial forms of silicosis [1]. Other authors assume presence of restrictive [2] or obstructive [3] functional ventilatory impairments. Some authors have found a radiographic pulmonary hyperventilation, related to decrease in FEV1 and FEV1/FVC in a group of patients with silicosis, who have standardized by exposure duration to dust, age, and tobacco – smoking [4]. X.R. Wang et al. [5] have reported a correlation between spirometric parameters and deviations in the diffusion capacity (DLco) – on the one side, and higher stages of silicosis – on the other. Lung function changes were found among patients with coal workers pneumoconiosis [4]. Using logistic regression analysis for the changes in the spirometric parameters (FEV1 and FEV1/FVC) and the correlation between their impairments and cumulative silica dust exposure was found by B. Ulvestad et al. [6]. Functional ventilatory impairments in different groups of dust exposed workers and in patients with late forms of silicosis, and individuals with conventional silicosis and silicotuberculosis were studied by E. Petrova [2, 7, 8, 9, 10, 11]. After a long monitoring of coal dust exposed workers without progressive massive fibrosis (PMF), R.S. Fraser et al. [12], and A. Miller et al. [13] have found interrelation between occupational exposure to dust and changes in FEV1. They have accepted the relationship between anthracosilicosis – type PMF and bronchial obstruction.

2. AIM

The aim of the study is to analyze the relationship between the decrease of FEF50% – on the one side, and the radiologically verified compensatory lung emphysema among workers, exposed to mineral dust at the work place - on the other.

3. MATERIALS AND METHODS

We have performed a nested case control study among 480 underground miners exposed to quartz, 120 asbestos exposed workers, and 121 non – exposed individuals. The average age of the examined individuals was 42.82 years, and the average duration of the dust exposure was 14.01 years. A clinical examination, chest radiography (by ILO'80), and spirometry of all persons were done. The lung emphysema among dust exposed workers was accounted qualitatively according to ILO'80, and semi-quantitatively as slight, moderate and severe form. We have used SPSS software and One-way ANOVA.

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4. Results

The analysis of the changes in the ventilatory parameter FEF50%, related to the appearance of radiologically accounted lung emphysema, is illustrated by Figure 1.

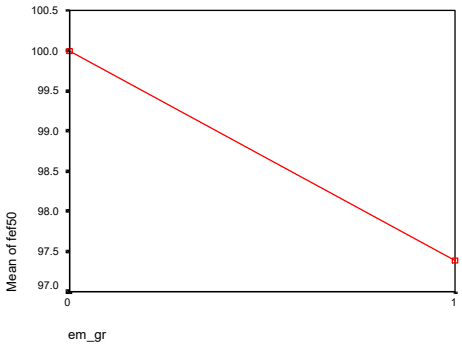

Figure 1. Mean value of $FEF_{50\%}$ depending on the radiologically verified pulmonary emphysema (em)
*Statistics: ANOVA (P = 0.019)

Interesting are the functionally–radiographic constellations of mutual influence of some functional respiratory parameters, related to the onset additional radiographic lung deviations as pulmonary emphysema in patients with initial mineral pneumoconiosis or among workers exposed to mineral dust. We found a relation between the appearance of pulmonary compensatory emphysema, and minimum reduction of FEF50% (50% of the maximal vital capacity - FVC), which was found within referent values. This tendency is statistically significant (P <0.02).

5. Discussion

The initial functional ventilatory insufficiency is characterized by 50% reduction of the maximum expiratory volume from the FVC curve (FEF50%) in patients with mild degree compensatory emphysema. The decrease of the mean value of FEF50% upon appearance of pulmonary compensatory emphysema could be explained with the structural changes in the terminal bronchioles and the respiratory bronchioles, which undergo obstruction or/and obliteration. This could be caused by formation of interstitial pulmonary fibrosis, related to mineral dust presence into the pulmonary interstitium. These functional impairments could give an explanation for so-called disease of the small airways among workers, exposed to mineral dust at the work place.

6. Conclusions

- We detected a constellation between the reduction of FEF50% and the appearance of mild-degree compensatory pulmonary emphysema among patients with pneumoconiosis and workers exposed to mineral dusts.
- The relation between radiologically detected lung emphysema and the low value of FEF50% could be used for constellation in prophylactic screening examinations and for health monitoring among workers exposed to mineral dust.

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