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Silicosis among Stone- Cutter Workers: A Cross-Sectional Study

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Background: Production process of most factory-made products is harmful to our health and environment. Silica is the most important stone used in stone cutting factories. Numerous researches have reported respiratory diseases due to the inhalation of these particles in various occupations. Silicosis is a disease with typical radiographic pattern caused as the result of inhalation of silica particles. According to the intensity of exposures and onset of initiation of clinical symptoms silicosis is classified into three groups of acute, chronic and accelerated forms. The present study evaluated silicosis among stone cutter workers.

Materials and Methods: This cross sectional study was performed on stone cutter workers in Malayer city (Azandarian) between 2008 and 2009. Respiratory data of our study participants were collected with a respiratory questionnaire and performing spirometry tests and chest radiography.

Results: Among our participants, 16 silicosis cases were diagnosed by radiographic changes. Among them, 10 workers had exposure for more than three years and 6 workers were smokers. Eleven workers had an abnormal radiographic pattern on their chest x-rays. Seven workers had obstructive and 4 workers had restrictive spirometric patterns.

Conclusion: Prevalence of silicosis was high among our understudy workers and preventive strategies are required to control it.

Key words: Silicosis, Stone- cutters, Spirometry, Chest Radiography

INTRODUCTION

Silica is the main component of sand. Cutting, breaking, crushing, drilling, grinding or abrasive blasting of these materials may produce fine silica dust. Silicosis occurs as the result of deposition of fine respirable dust (less than 10 micrometers in diameter) in the lungs (1).

Silicosis is the most common occupational lung disease worldwide, which occurs mostly in developing countries. In 1713; Ramazzini et al. reported a connection between asthmatic symptoms and sand-like substances in the lungs of stone cutters (2, 3). Production of dust increased significantly due to industrialization (1, 2). More than 24,000 deaths occurred annually in China due to silicosis between 1991 and 1995(4). In the United States, According to recent CDC data, it is estimated that two million workers have had occupational exposure to crystalline silica dust and 59,000 of these workers develop silicosis during their life course (1, 5).

Classification of silicosis is made according to the disease severity (including radiographic pattern), onset

and rapidity of progression and often relates to duration of exposure. The classification includes: Chronic simple silicosis (resulting from long-term exposure to relatively low concentrations of silica dust and also usually appearing 10-30 years after first exposure), accelerated silicosis that develops 5–10 years after first exposure to higher concentrations of silica dust and acute silicosis that develops a few weeks to five years after exposure to high concentrations of repairable silica dust (2, 3, 6).

The present study was performed for assessment of silicosis among stone cutter workers for early detection and timely prevention and control of disease.

MATERIALS AND METHODS

The present analytical cross-sectional study evaluated all workers (180 males) who worked in stone- cutting factories in Malayer-Azandarian (Hamadan province) between 2008 and 2009. Our study was approved by the Ethics Committee of Tehran University of Medical Sciences and Health Services. Data collection was done according to clinical examination forms (approved by the Ministry of Health) and a respiratory status checklist (designed and approved by occupational medicine research center) through interviewing the study participants. Study participants explained their chronic pulmonary illness and their lifestyle. Spirometry was performed for all cases at the same time for assessment of lung volumes and capacities. Based on their job description in stone-cutting factories, study participants were referred to a radiologist in Malayer city Hospital to obtain chest radiography. Afterwards, spirometry results and chest radiographies were evaluated and interpreted by specialists from the occupational medicine research center according to ATS and ILO guidelines, and silicosis was confirmed by chest radiography (1, 2, 6). Collected data were analyzed using SPSS version 16 software.

RESULTS

One-hundred eighty stone-cutter workers participated in this study. The mean age of participants was 31.98±9.26 (15-59) years; 25% of workers were younger than 25 years of age and 18% were over the age of 40 yrs. The mean duration of employment was 3.5± 2.87 years (range 6 months to 16 years). Seventy-two (40%) workers had working experience up to three yrs and 19% mentioned a working experience less than one year.

According to chest radiography, silicosis was diagnosed in sixteen workers (8.9%) and also ten workers with silicosis mentioned more than three years of working experience (Figure 1). In general, 40 workers (22.2%) were smokers and 6 workers with silicosis were smokers with mean smoking history of 5.5 years (5.5 Pack / Year). Seven workers had chronic lung disease and only one of them had history of lung disease.

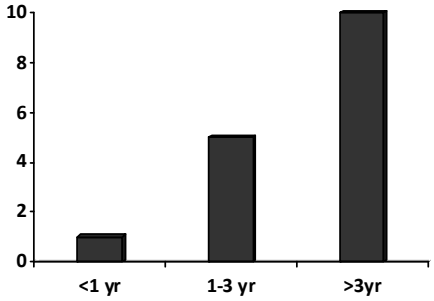

Figure1. Relative frequency distribution of silicosis cases according to their work experience at stone cutting factories in Malayer-Azandarian

Furthermore, 35 workers had abnormal spirometric findings. Eleven workers with silicosis had abnormal findings in their spirometry as well. Seven workers had obstructive and four had restrictive patterns (Figure 2).

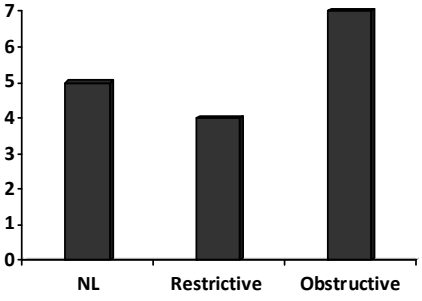

Figure2. Relative frequency distribution of spirometric patterns among silicosis cases working in stone cutting factories in Malayer-Azandarian

Sixteen workers had abnormality in their lung examination as respiratory symptoms, out of which 8 workers complained of irritating cough, 4 workers

complained of cough and dyspnea and 5 workers only complained of exertional dyspnea.

DISCUSSION

In our study 16 workers (8.9%) had silicosis. In a previous study in 2006, rate of silicosis in workers was reported to be 10% (7). Our study in comparison with the mentioned study showed a lower rate and this difference might be due to the higher use of personal protective equipment and shorter work experience in our study samples.

Gibbs and Du Toit in their study on gold miners of South Africa showed prevalence of silicosis to be 18.3-19.9% which was higher than our mentioned rate (8).

Out of 16 workers, 8 workers had irritating cough, 5 workers had cough and dyspnea and only 3 workers complained of exertional dyspnea. These findings were in accord with the results of similar studies at the same location in 2004 and 2006 (7, 9). In our study, the most common symptom was irritating cough (76%) in contrast to the study conducted in Nigeria which reported the most common symptom in workers with silicosis to be dyspnea and only 42% complained of cough (10).

Our study results demonstrated that 6 workers with silicosis were smokers. This finding is comparable with the results of a study in Hong Kong on the factors effective on and accompanied by progressive fibrosis in silicosis (4, 11).

Also, the spirometric pattern was abnormal in 11 workers with silicosis, 7 workers had obstructive patterns (two cases were smokers) while 4 workers had restrictive pattern (one smoker), in comparison with the previous studies that found a significant difference in spirometric patterns between workers with silicosis and healthy workers (2, 9). Correlation between lung function tests and chest radiograph was variable among South African gold miners and those with simple silicosis had lower FEV1 values. Pathologic studies demonstrating emphysematous changes supported these findings. Some studies reported the risk of silicosis to be correlated with the severity of exposure, type of silica particles, duration of exposure, and some other factors in a way that the higher the concentration of dust in the inspiratory air (as mg/m^3) and the more silica particles in the respirable sizes (in this study silica powder was within this range), the higher the risk of silicosis (3, 12, 13). Results confirm a large burden of silicosis among older black workers in the South African gold mining industry, which is likely to worsen as such miners spend longer periods in continuous employment in dusty jobs (14).

Based on the above-mentioned facts our results are consistent with those of other studies. Evidence indicates that exposure at the rate of OSHA (Occupational Safety and Health Administration) and MSHA (Mine Safety and Health Administration) standards (0.1 mg/m^3) for 100% respirable crystalline silica does not eradicate the risk of silicosis (15). This is also true about our study site because the concentration of silica particles was several-folds above the safe limit.

There were several limitations in our study. One problem was the impossible evaluation of type of silica particles; however, we were able to measure the concentration of dusts in this research. Another limitation was the absence of a system to detect and report silicosis cases regularly and also the inability for early or even late diagnosis of silicosis by physicians of that district. Therefore, the estimated number of diseased cases was far less than the actual rate. To overcome this problem, it is recommended to establish a system by the environmental and occupational health offices at the Ministry of Health for protection against silicosis and reporting cases from all over the country. We hope to take a step forward in eliminating or decreasing the risk of silicosis by undertaking these measures.

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environment according to the recommendations presented to them.

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