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ORIGINAL ARTICLE

Do sanitary ceramic workers have a worse presentation of chest radiographs or pulmonary function tests than other ceramic workers?

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KEYWORDS

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Background/Purpose: Silicosis remains the most prevalent occupational disease worldwide. There have been no specific studies focusing on the association between exposure settings at work and the clinical severity in silicosis patients. In this study, we describe and compare the clinical characteristics and silicosis-associated exposure history at work among workers from several types of ceramic production facilities in Taiwan.

Methods: We reviewed the medical records of 221 patients who were first diagnosed with silicosis at the Occupational Medicine Clinic of Northern Taiwan in 2012. For each patient, we collected data on demographic characteristics, smoking habits, working history, duration of exposure, and years on the first relevant job. We also retrieved clinical reports of the pulmonary function test and the baseline chest radiography used for silicosis staging.

Results: As compared to other ceramic workers, sanitary ceramic workers had a worse X-ray type ($p = 0.044$), more advanced age ($p < 0.001$), longer working duration ($p = 0.029$), and a higher proportion of starting the first relevant job prior to the year 1975 ($p = 0.003$).

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However, after adjusting for age, work duration, and an initial occupational exposure prior to 1975, sanitary ceramic workers showed a comparable risk for worse X-ray findings to other ceramic workers (adjusted odds ratio = 1.18, $p = 0.704$). Results of multivariable regression models on individual lung function parameter also suggested comparably impaired lung function tests between sanitary and other ceramic workers ($p > 0.05$).

Conclusion: In this study, we found that sanitary ceramic workers were at a similar risk to other ceramic workers for moderate to severe silicosis when older age and longer working duration were accounted for.

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Introduction

Silicosis refers to a spectrum of pulmonary diseases caused by the inhalation of free crystalline silica, and is one of the earliest recognized occupational diseases.^{1–3} Silicosis is affecting more than 80% of workers who have been suffering from occupational diseases in Taiwan since 1990, and at this time most of them are coal-mining workers.⁴ With the coal mining industry declining in recent decades, currently the major groups at risk for silicosis are workers from the sand blasting, stone cutting, construction, glass manufacturing, cement production, and ceramic production industries.⁵ Although advances in occupational safety and health make this disorder highly preventable, silicosis remains the most prevalent occupational disease worldwide.⁶ The epidemiologic and clinical aspects of silicosis and the pulmonary disease risks for workers exposed to silica, including those involved in ceramic production, have been well documented.^{3,7,8} Previously, some studies focused on the exposure–response relationships and risk estimations,⁹ and other studies evaluated the sex differences in workers affected by silicosis.^{10–12} However, no specific studies have focused on comparing the severity of silicosis across different dust concentrations according to the products' classification and exploring other confounding factors.

The ceramic production industries in Taiwan has involved with manufacturing products for daily use, sanitary, structural, art, refractory, technical, and raw materials. The traditional ceramic process generally follows the sequence of milling, batching, mixing, forming, drying, glazing, firing, and assembly. Possible dust exposure source during the process include raw material processing, milling, forming, spray drying, glazing, firing, and waste disposing. The major difference between different ceramic products was in the process of forming.

In a study conducted by the Institute of Occupational Safety and Health in Taiwan, total dust concentrations were measured in randomly selected factories with individual dosimetry and direct reading devices.¹³ The results revealed statistically higher concentrations of respirable particle (defined by the respirable particulate mass, according to the threshold limit values; TLV booklet of the American Conference of Governmental Industrial Hygienists¹⁴) in the sanitary ceramic factories than in other factories. In the outpatient setting, clinicians have also

observed that in pulmonary functions, the radiographic staging of sanitary ceramic workers seem to be worse compared with that of other ceramic workers.¹³ Therefore, in the current study, we sought to determine, among clinically diagnosed silicosis patients, whether sanitary ceramic workers were at a risk for having a worse presentation in X-ray imaging or in lung function testing results compared with other ceramic workers.

Patients and methods

Patients and setting

By reviewing the Medical Electronic Database, we retrospectively identified a group of patients who were diagnosed with silicosis at the Occupational and Environmental Medicine Outpatient Clinic in 2012. Most patients visited the Outpatient Clinic on their own volition or as referred by their friends; about 2% of the patients were referred by other clinicians.

We enrolled patients who had a clinical diagnosis of silicosis, which was based on the following diagnostic criteria [by the Occupational Safety and Health Administration, Ministry of Labor, Taiwan; modified based on the suggestion of the International Labor Organization (ILO)¹⁵]: a history of silica exposure sufficient to cause the degree of illness, and an appropriate time lag since the time of first exposure, as well as chest radiographs that showed profusion above type 1 (or ILO category 1); absence of another diagnosis that was more likely to be responsible for the observed abnormalities. Positive exposure history at work was defined as involvement in one of the following: ceramic manufacturing, mining, quarrying, sandblasting, masonry, and foundry work.

Standardized pulmonary function tests were performed by using a spirometer, and results of test parameters, such as forced vital capacity (FVC), forced expiratory volume measured during the 1st second (FEV₁), FEV₁/FVC ratio, and maximum midexpiratory flow (MMEF), were recorded. All radiographic staging was performed by the same occupational medicine specialist in accordance with the guidelines of the Council of Labor Affairs in Taiwan and the recommendations of the ILO.¹⁵ The type 1 X-ray in Taiwan is equal to the ILO classification scheme profusion category 1 (with subcategories 1/0, 1/1, 1/2), type 2 is equal to ILO

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