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Clinical Note

Silicosis: a Disease with an Active Present

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ABSTRACT

Silicosis, is an interstitial lung disease caused by inhaling crystalline silica dust. Despite it being one of the oldest occupational diseases, it continues being a cause of morbidity and mortality all over the world. The World Health Organisation and the International Labour Organisation (WHO/ILO) are aware of the current problem and have designed the International Programme on the Global Elimination of Silicosis, which identifies occupational groups at risk. We present 3 cases of silicosis in young construction workers, who are exposed to high concentrations of silica due to handling artificial silica conglomerates. The main objective of this study is to identify new risk sources, to highlight the dangers involved when the substance is used without any preventative measures, and to outline the importance of the occupational history to avoid under-diagnosis of this disease.

Silicosis, una enfermedad con presente activo

Palabras clave:
Silicosis
Historia laboral
Conglomerados de sílice cristalina

RESUMEN

La silicosis, enfermedad pulmonar intersticial causada por la inhalación de polvo de sílice cristalina, a pesar de ser una de las enfermedades de origen ocupacional más antiguas, continúa siendo causa de morbilidad y mortalidad en todo el mundo. La Organización Mundial de la Salud y la Organización Internacional del Trabajo (OMS/OIT), conscientes de la vigencia del problema, han diseñado el Programa Mundial para la Eliminación de la Silicosis, que incluye entre sus acciones la identificación de los grupos de trabajadores en riesgo. Presentamos 3 casos de silicosis en trabajadores jóvenes del sector de la construcción, con exposición a concentraciones elevadas de sílice por manipulación de conglomerados artificiales de sílice. El principal interés de esta observación radica en la identificación de nuevas fuentes de riesgo, en la necesidad de llamar la atención sobre la peligrosidad que entraña su uso sin medidas de prevención, y en la importancia de la historia laboral para evitar el infradiagnóstico.

Introduction

Silicosis is a lung disease caused by the inhalation crystalline silica dust. It is included in the group of pneumococci, which in turn are included among the diffuse interstitial lung diseases (ILD). The risk of disease is related to the amount of silica inhaled through a working life-time and, once established, there is not effective treatment. The control of respirable dust and early diagnosis are the most effective measures against this disease.[1]

Sources of occupational inhalation of silica are numerous, given that this mineral's dust is present in a broad industrial sector. There are many work positions in which objects that are shredded, cut, crushed, perforate, incised or ground where respirable aerosol of crystalline silica particles are liberated. The identification of these work posts with exposure to silica is vital to the prevention of the disease.

Three cases of silicosis observed in workers exposed to the dust generated by the manipulation of artificial quartz conglomerates are

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presented. This material is widely used in the decoration of interiors, kitchens and bathrooms, and is not included in the medical literature as a source of silicosis risk.

Clinical observation

Three males, active workers in a small ornamental rock company were studied. They had spent 17 years working in the placing of artificial quartz surfaces in houses and other buildings (fig. 1). They were referred to our consultation to assess the radiographic alterations observed in a periodical physical examination.

Case 1

A male patient, 32 years old with no harmful habits. He showed signs of grade 1 dyspnoea according to the Medical Research Council[2] score. There were no relevant findings in the physical examination. The lung function tests revealed a restrictive ventilatory defect: forced vital capacity (FVC) of 3,660ml (82%), forced expiratory volume at 1 second (FEV_1) of 3,070ml (81%), FEV_1/FVC of 84%, total lung capacity of 4,280ml (68%), functional residual capacity of 1,200ml (72%) and a decrease in the carbon monoxide transfer factor, which was 21.5ml/min/mmHg (69%). The chest x-ray, according to the year 2000 International Labour Office (ILO) classification,[3] displayed nodular q-r opacities with 2/2 profusion in both lungs, mainly in the mid lung zones. The high resolution computerised tomography confirmed a greater profusion of nodules in the posterior right region, where they conglomerated to form a mass of progressive massive fibrosis (fig. 2A).

Case 2

A male patient, 34 years old with no harmful habits or respiratory symptoms. The chest x-ray (ILO 2000) displayed diffuse nodular type

Figure 1. Quartz panels and some of their uses

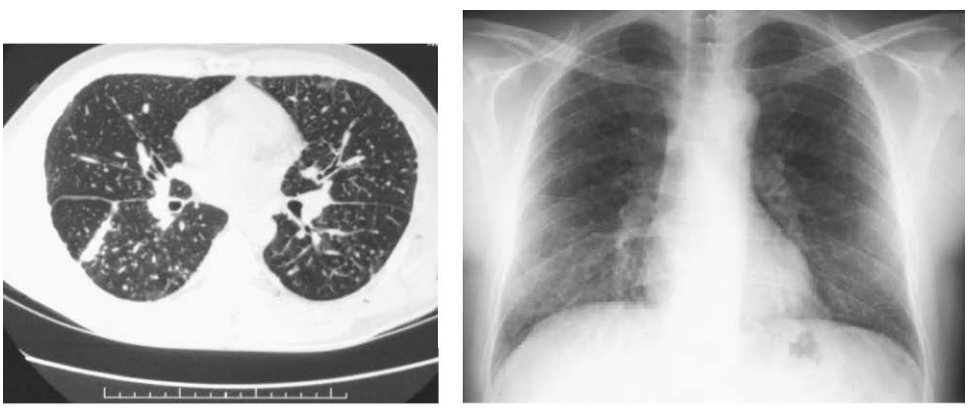

Figure 2. *A:* high resolution computerised tomography of case 1, in which parenchymatous nodes predominantly in posterior segments are observed, with formation of progressive massive fibrosis and subpleural nodulation. *B:* posteroanterior chest x-ray of case 3: size p-q, profusion 1/2 (International Labour Organisation 2000 classification).

p opacities with 2/1 profusion, predominant in the upper and mid regions, as well as adenopathies in the right paratracheal region. The lung function tests displayed values within the reference margins.

Case 3

Male, 37 years old with no pathological history or harmful habits, asymptomatic. Nodular p-q opacities were observed in the chest x-ray, with 1/2 profusion, diffuse distribution and predominance in the superior right lobe (fig. 2B). The lung function tests displayed values within the reference margins.

Discussion

Two cases of simple silicosis were presented and one case of complicated silicosis in active workers with an elevated background of silica inhalation. They worked installing quartz chipboard panelling for 17 years. These panels were composed of a high percentage of crystalline silica (70 to 90% according to the colour and type of finish) and in some cases, cristobalite, with variable aggregate grading (always below 4.5mm), all combined with other components (glasses, feldspars, pigments, etc.) bound with synthetic resins. This material was mainly cut in closed spaces, with no technical prevention measures (water jet cutting, ventilation, dust aspiration), neither did they use individual safeguards.

These workers' chest x-rays displayed infra-centimetric nodules, with bilateral diffuse distribution and more profuse localisation in the superior lobes, as well as a slight increase in mediastinal and/or hilar lymph nodes. In addition to this, in case 1, a conglomeration of nodes with formation of a mass of progressive massive fibrosis, in relation to complicated silicosis was observed. There were no associated symptoms or other systemic pathologic manifestations.

To establish a diagnosis of silicosis, it is enough to consider the concurrence of a working background of sufficient crystalline silica exposure and a variable latency period according to the scope of exposure, together with clinical, functional and typical radiological manifestations, along with the exclusion of other causes of ILD.[4] Performing other diagnostic procedures would only be indicated in the case of atypical presentations or a brief or poorly documented working background. Quantification of the exposure was not possible in the cases presented. These positions of "manipulation and installation" of previously processed material are subject to the supervision expressed in the Spanish Occupational Risk Prevention Act[5] in which an analysis of the respirable dust is only required on commencing the labour activity and when significant modifications are made to the working environment, which translates into there being just one sample of worker exposition to dust or to silica in most cases. However, certain similarities with samples registered for ornamental rock craftsmen (sandstones, granite, etc.) that are subject to the General Regulation of Basic Norms for Mining Safety and its Supplementary Technical Instructions (ITC), including the ITC 2.0.02[6] (ITC 2.0.02[6]) which requires samples of respirable dust to be taken every 4 months, which assures proper control of the exposure. These craftsmen use cutting tools similar to those used by the quartz chipboard panel installers, and the concentrations of respirable dust in their samples are, in the majority of cases, superior to the borderline value of 3mg/m^3 of dust when no safeguarding systems are used. If we also consider that on occasions these quartz chipboards also contain cristobalite, it seems correct to estimate that these workers have been exposed to very high concentration, with an extremely high risk of disease.[7] The radiologic alterations observed in our patients correspond with manifestations typical of silicosis[3] and as described, the cases of simple silicosis did not display any functional alterations. Nevertheless, the formation of masses of progressive massive fibrosis could cause restrictive respiratory defect and reduction of the diffusion capacity, as in case 1.[8] In addition to this, the appearance of the disease in a group of workers aided in excluding other diagnoses.

In Spain, statistics from the Spanish Institute of Silicosis[9] show an annual growth in the cases of silicosis parallel to the decrease in the number of cases of pneumococcus in coal workers, which is a sign of the changes taking place in the industrial sectors of the country. The manipulation of building materials that contain silica dust among its components has contributed to the appearance of new cases of silicosis in working environments unsuspected of being potential risks of contracting this disease. Studies performed on emerging industrial sectors highlight a very high prevalence of silicosis. In the granite industry, it reaches 18% of the active workforce,[10] and there has recently been an epidemic reported in the sandblasting of denim fabrics with silica sand.[11]

The inhalation of silica, as well as silicosis, can also cause lung cancer, kidney disease, loss of lung function and an increased risk of tuberculosis.[12] The observation of these cases brings into relief the dangers involved in the inappropriate handling of these new materials with high silica content. More effective prevention of the disease is a control of the harmful dust under the limit threshold values. Act ITC/2585/2007 for the protection of workers, in relation to silicosis in extractive industries, established that the concentration of silica contained in the respirable fraction of dust should not exceed 0.1mg/m^3 and that the amounts of cristobalite or tridymite should not exceed 0.05mg/m^3, which are even more harmful.[6] In relation to the cases presented, it must be pointed out that while during the manufacturing process of the panels thorough technical prevention safeguards are followed that keep the concentrations within the values mentioned, inappropriate handling during subsequent treatment can reach concentrations of respirable dust that are highly hazardous to health. In addition to this, the manufacturing plants that process these silica and resin conglomerates are bound by the ITC 2.0.20. Unidentified exposure leads to infradiagnosis of the acute types and the workers remain at their posts until more complicated and symptomatic types appear. Several studies have drawn attention to the infradiagnosis of work-related ILD due to a lack of data capture of labour backgrounds.[13]

The appearance of cases of silicosis, even of complicated cases, in young workers highlights the validity of this disease and reminds us of the need to perform comprehensive labour case histories as a mandatory step towards establishing a diagnosis.[14] The identification of the disease requires avoiding exposition in work environments and an evaluation of tubercular infection treatment.[15,16]

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