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Editorial

Proteomics and Silica Dust: A Call to Reinforce Occupational History-taking

Proteómica y polvo de sílice: una llamada a reforzar la anamnesis ocupacional

Silica, also known as silicon dioxide (SiO_2), is element number 14 in the periodic table and the second most abundant element in the Earth's crust, surpassed only by oxygen.[1]

Silica exposure occurs predominantly in occupational settings, affecting workers who handle materials containing this compound.[2,3] Among them are miners and quarry workers, construction workers (particularly those involved in demolition or cement and mortar mixing), foundry workers, employees in glass or ceramic industries, individuals engaged in polishing or cutting stone, marble, or granite, and those using abrasive techniques such as sandblasting.[2–4]

The impact of silica on the respiratory system is not a recent discovery. From the first descriptions attributed to Hippocrates in 430 BC, through the marked increase in cases and knowledge of silicosis during the Industrial Revolution at the end of the 19th century,[5] to more recent outbreaks in sectors such as the engineered stone countertop industry,[3] silica exposure has remained a constant concern. However, its effects are not limited to fibrotic lung disease. Increasing evidence suggests that silica may play a relevant role in the development and modulation of systemic autoimmune diseases, with epidemiological data supporting an association between silica exposure and several systemic autoimmune disorders, such as systemic sclerosis (SSc).[6–9] The health impact of exposure to this agent therefore remains fully relevant today.

In parallel, advances in the omics sciences have revolutionized our understanding of disease. Disciplines, such as genomics, transcriptomics, metabolomics and proteomics, systematically and comprehensively study complete sets of biological molecules in cells, tissues, or organisms, enabling the simultaneous analysis of thousands of molecules. These approaches facilitate a deeper understanding of biological interactions and regulatory networks and are essential for the development of personalized medicine.[10,11]

Numerous authors have explored the relationship between silica exposure and systemic autoimmune diseases, an association that appears reasonably robust from an epidemiological perspective. Given that the underlying pathophysiological mechanisms are not yet fully elucidated, several hypotheses have been proposed. These include the activation of macrophages following silica inhalation, with subsequent apoptosis leading to T- and B-lymphocyte activation and induction of autoimmunity, as well as preferential apoptosis of regulatory T lymphocytes over effector T cells, resulting in an immune imbalance.[7–9] In a recent publication, serum proteomic profiles were analyzed in patients with SSc, comparing patients with a history of silica exposure to non-exposed individuals. The authors identified significant differences in the expression of several proteins involved in inflammatory, vascular, and antifibrotic pathways. Beyond the specific findings, the underlying message is clear: occupational exposure leaves a detectable "biological footprint," even years later, which may help to better explain the clinical heterogeneity of the disease.[12]

In everyday clinical practice, enquiring about a patient's occupation is often limited to recording a generic job title, without exploring specific tasks, duration of exposure, changes throughout working life, or the use of personal protective equipment. In pulmonology – and particularly in patients with interstitial lung disease, autoimmune conditions, or unexplained respiratory symptoms – this approach is clearly insufficient. Moreover, patients frequently underestimate their exposure to silica. As shown by Galli et al., in a cohort of patients with SSc, only 6.3% reported any silica exposure during routine history-taking, whereas up to 10.1% were identified as exposed when assessed using job-exposure matrices (JEMs).[13]

JEMs are cross-referencing epidemiological tools that provide retrospective exposure estimates based on occupational history. These matrices are structured around two main axes[1]: job titles classified according to predefined occupational classification systems, and[2] different exposure metrics or indices.[14] In the specific case of silica, the recommended JEMs are those developed by *Santé Publique France*, which include estimates of exposure probability (percentage), frequency (days), and intensity of exposure expressed in mg/m^3 or parts per million.[15]

Integrating occupational history-taking into the era of precision medicine is therefore not only coherent, but essential. We frequently refer to the omics sciences as pillars of the future of medicine, yet we often overlook "exposomics": the totality of environmental and occupational exposures experienced by an individual throughout life. Occupational history is probably the most accessible, cost-effective, and direct way to approach this dimension. Studies such as that of Freire et al. should serve as a stimulus to reinforce this aspect of clinical practice, reminding us that a well-

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formulated question in the consultation room can be as valuable as the most advanced laboratory technique.[6,16]

In conclusion, silicosis and silica exposure do not belong to the past, and their effects extend beyond the lungs. Proteomics provides new insights into how these agents influence complex diseases such as systemic sclerosis, but these findings can only be translated into meaningful clinical knowledge if they are supported by rigorous occupational history-taking. At a time when medicine is moving toward increasing personalization, reclaiming and strengthening occupational history is not an exercise in clinical nostalgia, but a necessity grounded in the best available scientific evidence.

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Conflicts of interest

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