In a 22-year study in 18 plants of 4,027 domestic industrial sand workers exposed to crystalline silica, Steenland and Sanderson (1) observed a 60 percent excess of lung cancer mortality in the exposed cohort compared with the US male population. This finding supports the 1997 judgment by the International Agency for Research on Cancer that inhaled crystalline silica from occupational sources is a carcinogen (2). Indeed, as early as 1940, inhaled silica was shown to induce lung cancers in mice (3).

However, the International Agency for Research on Cancer noted that the epidemiologic evidence was not entirely consistent and that different forms of silica might vary in carcinogenic efficacy. A possible cause of fluctuation in potency might be variable contamination of silica with a known carcinogen such as iron (4). In addition, inconsistency could reflect different levels of tissue iron in persons who inhale silica. Evidence is available to support each of these possibilities.

Ghio et al. (5) observed that the ability of silica to stimulate production of reactive oxygen radicals and induce lung inflammation was suppressed by the iron chelator desferrioxamine. Furthermore, in rats exposed to silica, exogenous iron contamination of the inhaled sand markedly enhanced such lung responses as leukocyte recruitment, macrophage synthesis of oxygen radicals and nitric oxide, and lipid peroxidation (6).

Moreover, after introduction of silica into the lower respiratory tract, surface complexation of iron has been observed to occur on the phagocytosed particles (5). Subsequently, silica was instilled intratracheally in rats maintained on low- or high-iron diets. Compared with animals fed high-iron diets, rats on the low amount of iron had diminished fibrotic injury (7).

Iron loading of humans can occur via alimentary or respiratory routes. Ingestion of excessive amounts of red meat or of alcohol as well as several genetic disorders can enhance intestinal absorption of iron. Sources of inhaled iron include mainstream cigarette smoke, asbestos, and urban air particles (4). Thus, both the use of protective masks and measures to reduce alimentary iron loading might be useful in minimizing the carcinogenic danger of silica for industrial sand workers.

REFERENCES


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Editor’s note: In accordance with Journal policy, Drs. Steenland and Sanderson were asked whether they wished to respond to this letter but chose not to do so.