Pulmonary Fibrosis Associated with Aluminum Trihydrate (Corian) Dust

TO THE EDITOR: A 64-year-old man who was an exercise physiologist was noted to have clinical and physiological features of idiopathic pulmonary fibrosis.[1] On detailed questioning, he stated that he had ground, machined, drilled, and sanded Corian (a solid-surface material composed of acrylic polymer and aluminum trihydrate[2]) in his garage for about 16 years (Fig. 1A). He had typical clinical features of idiopathic pulmonary fibrosis and radiographic features of usual interstitial pneumonia, and a surgical lung biopsy showed histologic features of usual interstitial pneumonia (Fig. 1B and 1C), a hallmark of idiopathic pulmonary fibrosis. Prompted by an elic-

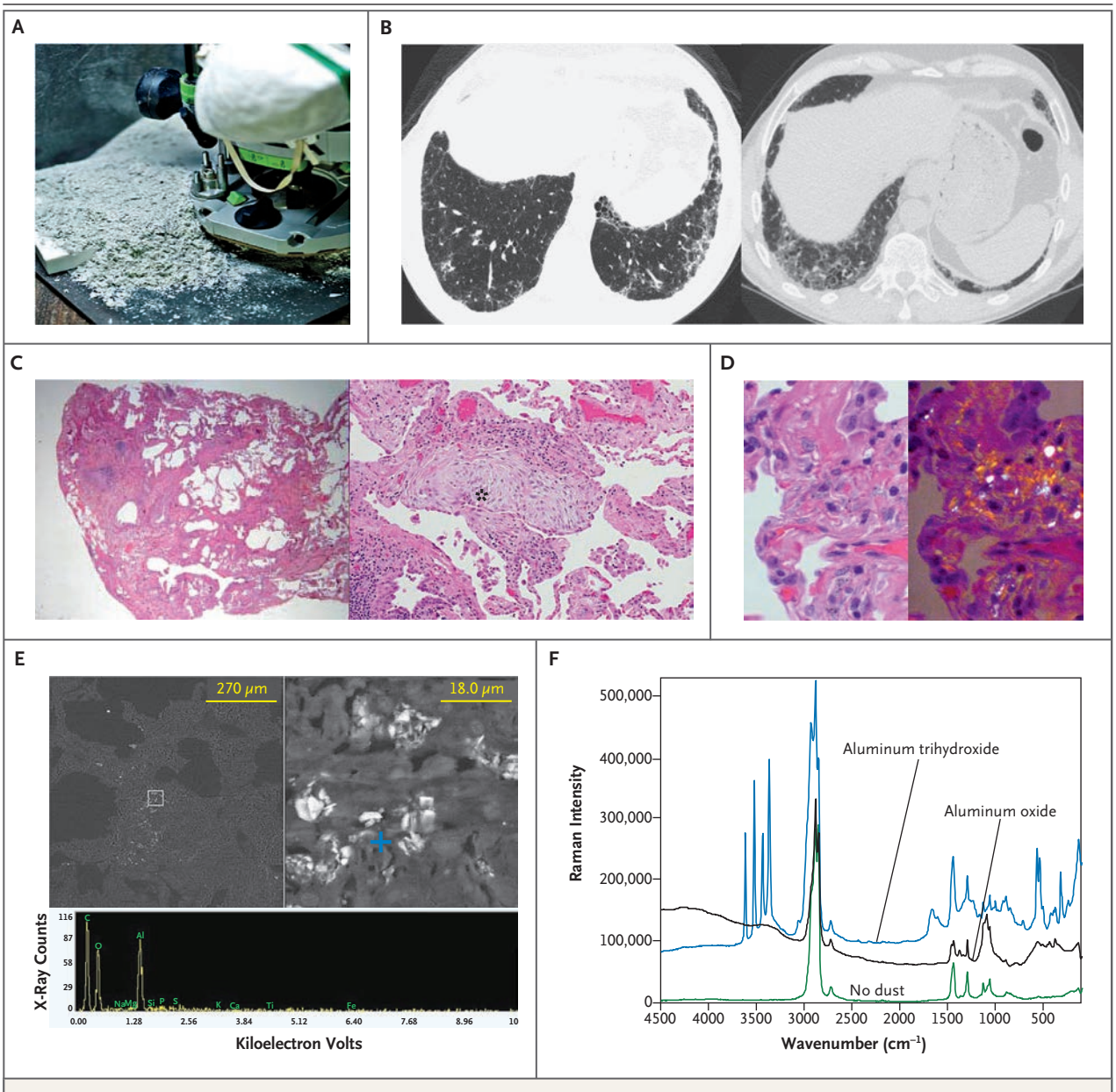

Figure 1. Findings Indicating a Potential Causal Relationship between Corian Dust and Pulmonary Fibrosis in the Patient.

In Panel A, Corian dust from the patient's garage is shown. (Photograph courtesy of the patient, Dr. G. Leroy Eckardt.) In Panel B, high-resolution computed tomographic images of the patient's lungs show a pattern suggestive of usual interstitial pneumonia.[1] In Panel C, hematoxylin-and-eosin staining also shows the pattern of usual interstitial pneumonia (patchy fibrosis and a fibroblast focus [asterisk]) in a surgical lung-biopsy specimen obtained from the patient's right lower lobe. In Panel D, abundant translucent, birefringent particles are visible in the areas of fibrosis and, to a lesser degree, in a lymphatic distribution around small vessels and airways (left). These particles, detected by means of polarized light microscopy, are shown (right). In Panel E, scanning electron microscopy at low magnification (top left) and high magnification (top right) with energy dispersive x-ray spectroscopy (bottom) shows that the most abundant particles in the lung contained aluminum (Al) and oxygen (O) (consistent with aluminum trihydroxide or aluminum oxide). In Panel F, the results of Raman spectroscopy, which yields emission peaks at wavelengths and allows structural assignment to various chemical bonds (such as oxygen–hydrogen), are shown. Peaks associated with lung tissue with the presence of aluminum oxide and aluminum trihydroxide, and with an absence of dust are shown. (Graph courtesy of Dr. Thomas Tague, Bruker Instruments.)

ited history of exposure and findings on polarized light microscopy (Fig. 1D), we conducted further tissue analyses that showed aluminum trihydroxide in the fibrotic lung (Fig. 1E and 1F); this finding provided support for a potential causal relationship between the Corian dust and pulmonary fibrosis. Although the patient avoided further exposure to Corian dust, his respiratory status slowly deteriorated over the next 7 years and he died from respiratory failure secondary to pulmonary fibrosis. High-resolution computed tomographic images of the chest showed an overall pattern that was consistent with end-stage usual interstitial pneumonia. At autopsy, the lungs were small; aluminum trihydroxide was detected in the fibrotic lungs.

Although the evidence from this single case is circumstantial, the history of exposure, analyses of the lung tissue, and the sample of dust obtained from the patient's environment are consistent with a causal association. Pulmonary fibrosis has been associated with metal dusts and aluminum.[3,4] A meta-analysis of six case–control studies of idiopathic pulmonary fibrosis showed a significant association between metal exposures and this condition.[5] Without the elicited history of exposure to Corian dust and the finding of birefringent particles in the tissue, we would not have considered Corian dust as a potential cause of pulmonary fibrosis and the patient would have been considered to have idiopathic pulmonary fibrosis.[1] Although the findings from this case do not confirm causality, until further data to support or refute the association are available, inquiry into each patient's occupational and environmental exposures should be made when considering a diagnosis of idiopathic pulmonary fibrosis.

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Disclosure forms provided by the authors are available with the full text of this letter at NEJM.org.

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We thank G. Leroy Eckardt, Ph.D. (the patient), and his wife and family for providing the samples of dust from his garage for analysis and for permitting us to report this case.

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DUPONT, THE MANUFACTURER OF CORIAN, REPLIES:

The letter by Raghu et al. regarding the presence of idiopathic pulmonary fibrosis in a 64-year-old man at the time of death suggests a circumstantial association between the patient's pulmonary fibrosis and aluminum trihydrate (a material typically found in solid surfaces). When handled in accordance with recommended safety guidelines, solid-surface products have been fabricated (i.e., cut, drilled, and sanded) safely for nearly 50 years.

Reasonable scientific inquiry calls for further exploration of whether the patient described in the letter may have been exposed to other materials that contributed to or caused pulmonary fibrosis. There is a large body of published articles on the potential effects of occupational exposure to aluminum compounds. However, a review by Krewski et al.[1] in 2007 showed that most respiratory problems in aluminum workers were not due to exposure to aluminum compounds, but rather to other substances in the workplace or to coexisting exposures. Indeed, of the three articles cited in the authors' letter in support of causality, only one, by Jederlinic et al., even mentions aluminum specifically, and Jederlinic and colleagues note in their analysis that an alternative cause for the pulmonary fibrosis could be "mixed dust" pneumoconiosis. Furthermore, in another article referenced by Raghu and colleagues, Taskar and Coultas cite a number of causes of idiopathic pulmonary fibrosis, including wood dust and agriculture, but they do not refer to any aluminum compounds.

Millions of tons of aluminum compounds,

including aluminum hydroxides and aluminum oxides, are produced annually and are used in products ranging from food additives and pharmaceuticals to abrasives, ceramics, and fire retardants. Thus, there are many potential sources of exposure to aluminum compounds, especially in industrial settings.

Clearly, there are a number of unanswered questions surrounding this patient's history and medical condition. We would have liked the opportunity to review or discuss this matter with the authors before publication, and we would still welcome the opportunity to do so.

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