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Case Report: Bronchiolitis Obliterans Organizing Pneumonia in a Spice Process Technician

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To the Editor:

A 43-year-old African American man began working as a process technician for a potato chip manufacturer in 1988. Between 1990 and 1997, his primary responsibility was to operate and fill the hopper of a misting device that sprayed spices onto the chips. He performed this duty by manually dumping the spices from bags. This operation was very dusty, and the equipment in this area of the plant accumulated a layer of spice dust that was cleaned daily using brushes and a compressed air hose. He reported that the label on the seasoning mix cautioned against prolonged inhalation of the dust because it was known to cause both upper and lower respiratory tract irritation. Many different types of seasoning are used at the plant, depending on the product, including salt, pepper, onion, garlic, and paprika. However, the exact contents of each spice preparation are considered proprietary, and the full list of ingredients was not available for review.

The seasoning bag dumping station where he worked was identified as the major source for airborne dust concentrations, and a red dust was noted to be present on the equipment. In addition to the spice dust, he was exposed to a cleaning solution that smelled like chlorine, which was used to clean the potato slicer. He also noted that he was exposed to fugitive emissions from the frying process that used corn and soybean oil. He wore gloves when handling the cleaning solution, because it was known to cause burns with skin contact. Dust masks were available but not required to be used, and he never used any respiratory protection. He denied any history of significant exposure to coal dust, silica dust, asbestos fibers, beryllium or cobalt. Prior to his work as a process technician, he was employed for 3 years as a manager of a convenience store, and before that he had worked 3 years at a bank. He denied exposure to any other chemicals or hazardous dusts during his prior employment or in pursuit of hobbies.

During his employment the patient frequently complained of eye and nasal irritation, sinus congestion, and sneezing when exposed to the spice dust at work. In fall 1996 he noticed a significant decrease in his exercise capacity, shortness of breath, and fatigue. By February 1997 he complained of worsening symptoms and developed an acute illness, complaining of dizziness, coughing, and shortness of breath while at work. He was seen at a local hospital and treated for bibasilar pneumonia with a 2-week course of Biaxin and was told to stay out of work. After completion of the antibiotic therapy, he returned to the doctor because of worsening complaints of shortness of breath and fatigue. He was hospitalized for several weeks. At the time of admission, he was noted to be afebrile and his lung examination showed bibasilar crackles. A chest radiograph showed diffuse bibasilar infiltrates, and pulmonary function showed restriction. His arterial blood gases revealed a partial pressure of oxygen of 66 mm Hg, a partial pressure of carbon dioxide of 41 mm Hg, and a pH of 7.4 on room air. An open lung biopsy showed bronchiolitis obliterans organizing pneumonia. He was treated with high-dose prednisone initially for 6 months, which was then tapered off. After a relapse, he was treated with an additional 18 months of oral steroid therapy and has remained stable. However, he requires the use of supplemental oxygen, is disabled, and has been out of work since February 1997.

Additional testing to evaluate the patient's illness have included antiproteinase-3 antibody, antimyeloperoxidase antibody, rheumatoid factor, angiotensin-converting enzyme, and antinuclear antibody, which were all negative. A renal profile was also normal. A mycoplasma immunoglobulin G titer done on March 5, 1997, was positive at 1:16, indicating past exposure. A hypersensitivity panel done the same day was negative. His sedimentation rate was 2 mm/hr. Because of a relapse in his condition, a bronchoscopy was performed on March 20, 1998, with bronchoalveolar lavage of the right middle lobe, transbronchial biopsy of the right lower lobe, and brushings of the right upper, middle, and lower lobes. The biopsy report showed "few fibrous plugs suggestive of residual bronchiolitis obliterans." All other diagnostic studies performed on the tissue and fluid were negative, including acid-fast bacillus cultures and stain, gram stain, cytology, and fungal cultures.

The subject's past medical history was significant for atypical chest pain, but diagnostic studies indicated no cardiovascular disease. He had smoked one pack of cigarettes for 12 years between 1978 and 1990. His family history was unremarkable.

The subject's physical examination was unremarkable, with the exception of requiring oxygen. Specifically, he had no lung findings of wheezes, rales, rhonchi, or pleural rubs. Pulmonary function studies showed moderate restriction, consistent with AMA Class 3 Impairment.

Discussion: Bronchiolitis obliterans organizing pneumonia (BOOP) is not a new disease, but it has been described as a distinct entity 1 with different clinical, radiographic, and prognostic features than the airway disorder bronchiolitis obliterans and the interstitial fibrotic lung disorder, usual interstitial pneumonia/idiopathic pulmonary fibrosis. 2 The main histological feature distinguishing BOOP from interstitial pneumonias is that the fibrosing process involves predominantly airspaces rather than interstitium. BOOP is characterized by polypoid endobronchial connective tissue masses composed of myxoid fibroblastic tissue resembling granulation tissue filling the lumens of terminal and respiratory bronchioles and extending in a continuous fashion into alveolar ducts and alveoli, representing an organizing pneumonia. 3 BOOP is a restrictive lung disease with diffuse, bilateral patchy, radiographic infiltrates and a clinical onset that is often acute that mimics atypical pneumonia. BOOP is reversible with treatment (oral prednisone) in over 60% of cases, 4 but it has the potential for progressing to irreversible pulmonary fibrosis and end-stage honeycomb lung.

We report on a case of BOOP in an African American man employed as a snack chip spicing technician. Unfortunately, we did not have access to the workplace or to the proprietary formula for the spices used in the spicing operation. However, the patient's description of the process suggested significant exposure to airborne spice dust. In our review of the medical literature, we found a long association of paprika (one of the spices to which the patient was exposed) causing occupational lung disease, specifically, hypersensitivity pneumonitis or allergic alveolitis. Paprika Splitter's Lung is caused from inhalation of organic material in the processing of the paprika fruit. 5 It has been suggested that workers who developed Paprika Splitter's Lung were actually responding to a fungal element (*mucor stolonifer*) associated with paprika rather than the paprika fruit itself. 6 Paprika and other spices have also been associated with immunoglobulin E-mediated occupational lung disease causing immediate asthmatic responses in some patients. 7,8 We found no reports supporting occupational BOOP in spice workers.

With this information, we questioned whether the patient may have had a component of hypersensitivity pneumonitis with secondary BOOP, and we obtained a second histopathological opinion at Duke Medical Center. The final opinion from the pulmonary pathologist commenting on the open lung biopsy tissue described, "A pattern of patchy acute pulmonary injury characterized by the presence of loose plugs and edematous connective tissue within alveolar ducts and terminal bronchioles [is] noted. No necrosis is seen. No significant interstitial fibrosis is present. The small airways also demonstrate moderate chronic inflammatory change. No granulomata are seen." Thus, the potential for BOOP in association with hypersensitivity pneumonia seemed to be ruled out.

BOOP has been observed following infectious illnesses, including chlamydia, legionella, mycoplasma, adenovirus, cytomegalovirus, influenza virus, malaria, pneumocystis, and cryptococcus. An infectious cause appears unlikely from the clinical workup. There was no evidence in the medical record for some of the other known causes of BOOP, including toxic fume inhalation, connective tissues disorder, adult respiratory distress syndrome, or aspiration pneumonitis, and the patient had not undergone organ transplantation. Our finding of what seems to be an occupation-associated BOOP in a spicing technician makes us question whether there are similar cases that have not been reported. In a telephone conversation with the National Institutes for Occupational Safety and Health (NIOSH) in Morgantown, we discovered that researchers are currently investigating cases of bronchiolitis obliterans in another industry that uses spices. The following letter reports preliminary findings of the cases they have studied. Further research is needed to determine the exact agent(s) responsible for respiratory disease in spice industry workers.

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