

Microwave Popcorn Lung

There have been a number of recent articles both in the medical literature and the popular press about the development of bronchiolitis obliterans from exposure to microwave popcorn (popcorn worker's lung). There have been no reported cases in Michigan despite an estimated 100 food/snack manufacturing companies in Michigan that are potential users of diacetyl (2,3-butanedione), the presumed etiologic agent. Diacetyl is an organic chemical used to make synthetic butter flavoring. The estimate of 100 food manufacturing companies in Michigan is based on the standardized industrial code for the type of company where diacetyl might be expected to be used. We have no information on whether diacetyl is actually used at these facilities.

A cluster of bronchiolitis obliterans in 8 workers was first reported in the New England

Journal of Medicine in 2002 from a microwave popcorn plant in Missouri (1). Individuals had become ill from 1993-2000 and many were first diagnosed as having asthma or chronic bronchitis before the cluster was recognized. More recently a cluster was reported in California (2). Two case reports are summarized on page 3 of this newsletter. Common clinical findings included an absence of a response on pulmonary functions to a bronchodilator, a normal chest radiograph, and a normal diffusing capacity. Spirometry showed a fixed obstruction and lung volumes showed air trapping with an increased residual volume. These findings could easily lead to the diagnosis of COPD. A clustering of patients, the absence of cigarette smoking or consideration of the patient's work history would all be useful in reaching the correct diagnosis. The initial report found the greatest

****DIAGNOSTIC CRITERIA FOR BRONCHIOLITIS OBLITERANS****

The diagnosis of bronchiolitis obliterans is the presence of fixed obstruction on spirometry, air trapping on lung volumes, and a high-resolution computed tomography (HRCT) scan which shows air trapping with hypoattenuation in segmented or lobular areas and a mosaic pattern of perfusion. The HRCT findings may only be present on an expiratory HRCT. Although the HRCT pattern in bronchiolitis obliterans is different than that seen in cigarette smokers, the presence of fixed obstruction in a non-smoker or a person with a minimal smoking history is more likely to raise the consideration of bronchiolitis obliterans. Because the histiologic findings of bronchiolitis obliterans are patchy, and may be difficult to identify, lung biopsies may give false negative results. Lung biopsies should not be necessary in the presence of fixed obstruction, and a typical HRCT. Other causes of bronchiolitis obliterans are acute sudden exposure to toxic gases such as oxides of nitrogen (silo-filler's disease), ammonia or chlorine; post infectious changes(children more than adults); an unusual drug reaction for example caused by penicillamine; connective tissue disease; or a complication of an organ transplant.

****NEW REPORTING REGULATIONS****

The reporting of work related illnesses by Physicians and other health care providers has been required by Michigan law since 1978. On September 18, 2007, new regulations went into effect that now also require health care providers to report non work-related chemical poisoning **upon request from state or local public health agencies**. These regulations cover all environmental and home poisonings such as that in a consumer who develops bronchiolitis obliterans from cooking microwave popcorn that has butter flavoring containing diacetyl. It does not cover poisoning from suicides or illnesses secondary to medication. Questions about these new regulations should be directed to Martha Stanbury at stanburym@michigan.gov or 517 335-8364.

risk for bronchiolitis obliterans in the mixing area where diacetyl air levels were the highest. Toxicological studies in rodents have backed up the epidemiologic findings that diacetyl is the etiologic agent (3).

Another recent study, this one on workers in a chemical manufacturer of diacetyl reported additional cases of bronchiolitis obliterans, again finding an association with diacetyl. The findings from this study could not exclude acetoin, an intermediary of diacetyl in the chemical production process, as possibly also being an etiologic agent (4).

The recent stories in the news media were based on the release of a letter from a pulmonary physician at the National Jewish Medical and Research Center in Denver, Colorado. The pulmonologist reported a case of bronchiolitis obliterans in a 53 year old man who for the past 10 years had eaten microwave popcorn two times per day and also enjoyed inhaling the butter flavored steam from the freshly opened bag. Diacetyl levels in his home were equivalent to peak levels found in

manufacturing facilities. The pulmonary physician had written a letter in July to a number of regulatory agencies including the FDA and OSHA informing them about the case. There has been no action by OSHA to regulate diacetyl exposure in the workplace despite petitions and congressional hearings. With the recent case report of bronchiolitis obliterans possibly secondary to the use of microwave popcorn by a consumer, a number of large food manufacturers have indicated that because of concern about possible adverse health effects to their workers they will phase out the use of diacetyl over the next year. The press releases from these companies emphasized they did not believe there was a risk to the consumer.

In the meantime, diacetyl is continuing to be used without regulations and not all manufacturers have announced a phase out. We would be interested in knowing about any known or suspected cases of bronchiolitis obliterans from chemical exposure. Please call Dr. Rosenman at 1-800-446-7805 if you have any questions or wish to report a case.

References

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Case Report (MMWR, 2007)

“In September 2003, a man aged 29 years with no history of smoking, lung disease, or respiratory symptoms developed progressive shortness of breath on exertion, decreased exercise tolerance, intermittent wheezing, left-sided chest pain, and a productive cough 2 years after beginning employment as a flavor compounder. His job involved measuring diacetyl and other ingredients to prepare batches of powder flavorings. The workplace did not have effective methods for controlling exposure to the flavoring chemicals, such as local exhaust ventilation or adequate use of respirators to reduce exposure to organic compounds and powders. The worker reported wearing a paper dust mask and occasionally a cartridge respirator for organic vapors. However, he never received a fit test for the respirator. He had a beard at the time, which precluded a proper fit, and he was not adequately protected from both volatile organic chemicals and particulates.

In November 2003, the man went to his primary-care physician and was treated with antibiotics and bronchodilators for suspected bronchitis and allergic rhinitis. In January 2004, he stopped working because of his respiratory symptoms. His shortness of breath became more severe, with dyspnea after walking 10--15 feet. A high-resolution computed tomography (HRCT) scan of his chest showed cylindrical bronchiectasis in the lower lobes, with scattered peribronchial ground-glass opacities. In April 2004, spirometry showed severe obstructive lung disease, with a forced expiratory volume in 1 second (FEV₁) of 28% of the predicted normal value, without bronchodilator response. Static lung volumes by body plethysmography were consistent with severe air trapping. Diffusing capacity was normal.

In October 2004, the patient was referred for an occupational pulmonary consultation. Paired inspiratory and expiratory HRCT scans showed central peribronchial thickening with central airway dilatation and subtle areas of mosaic attenuation scattered throughout the lungs, predominantly in the right lower lobe. The diagnosis of work-related bronchiolitis obliterans was made on the basis of history, fixed airway obstruction with normal diffusing capacity, and typical HRCT findings. Diacetyl is considered the cause of this patient's disease on the basis of its known toxic effects; however, exposure to other less well-characterized flavoring chemicals might also have contributed.”

Case Report (Kreiss et al, NEJM 2002)

“A housewife began her first job in October 1993, at the age of 40, on the microwave-popcorn packaging line at the plant. She had no chest symptoms, had never smoked, and was accustomed to walking three to five miles (5 to 8 km) daily. In March 1994, she started coughing about three hours after the start of her evening shift, without any changes in her work environment or her usual seated job activities and without any improvement in this symptom while she was away from work. Two to three weeks later, myalgias, night sweats, and exercise-induced exacerbation of the cough developed. Gradually, exertional dyspnea developed and prevented her from taking her accustomed walks and from lifting 25-lb (11-kg) boxes at work. In April, her dry cough became productive; she consulted an allergist because of right-sided chest pain, and the allergist diagnosed bronchitis, hay fever, and asthma. Use of a bronchodilator did not result in an improvement in symptoms. In June, she consulted a pulmonologist, who documented a forced expiratory volume in one second (FEV₁) of 0.86 liter (30 percent of the predicted value), a forced vital capacity (FVC) of 2.27 liters (66 percent of the predicted value), and a normal diffusing capacity for carbon monoxide. The patient stopped working in mid-June; she had lost 8 lb (3.6 kg) over the course of her employment. Her dyspnea subsequently increased, but her cough slowly improved.

In October 1994, the patient's FEV₁ was 0.73 liter (24 percent of the predicted value), with no response to a bronchodilator; the total lung capacity was 6.1 liters (120 percent of the predicted value); the residual volume was 3.1 liters (251 percent of the predicted value); and the airway resistance was 441 percent of the predicted value. The carbon monoxide diffusing capacity was 85 percent of the predicted value, but she had a decrease in oxygen saturation, from 95 percent to 88 percent during a three-minute walk and to 87 percent during a six-minute walk. High-resolution computed tomography showed minimal, diffuse bronchial-wall thickening; air trapping; and a right-upper-lobe granuloma. Thoracoscopic lung biopsy revealed scattered, non-necrotizing granulomas; focal bronchiolar fibrosis; fibroblast proliferation compressing one bronchiolar lumen; and no interstitial pneumonia. The patient had no response to high-dose prednisone and only a symptomatic response to a three-month course of cyclophosphamide (100 mg per day). She was placed on a waiting list for a lung transplant in November 1995 but has not received a transplant. Her FEV₁ in December 2001 was 0.61 liter (21 percent of the predicted value).”

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In this issue:
v18n4: Microwave Popcorn Lung

*PS Remember to report all cases of occupational disease!

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the Reporting of
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Occupational Diseases

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The Project SENSOR News is published
quarterly by Michigan State University-College
of Human Medicine with funding from the
National Institute for Occupational Safety and
Health and is available at no cost. Suggestions
and comments are welcome.

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