

Sixty-Four Michigan Patients Hospitalized or Treated in the Emergency Department with Lung Disease from Waterproofing Sprays

The last issue of the SENSOR newsletter discussed the occurrence of bronchiolitis obliterans after exposure to a synthetic butter flavoring used in microwave popcorn.

This issue of the newsletter will discuss chemical

pneumonitis that has occurred from exposure to waterproofing sprayed on boot/shoes, tents, tile or grout. There have been 64 individuals hospitalized or treated in the emergency department in Michigan reported to the state from 2003 to 2007. (Table I).

Table I. Patients Hospitalized or Treated in the ED with Lung Disease from Exposure to Waterproof Spraying, Reported to the State of Michigan, 2003-2007

Year	Number of Patients	Source of Exposure	Percent Hospitalized	Percent Treated in ED
2003	1	Tent	0	100
2004	14	Tent	7	93
2005	30	Tent, Boot, Grout	50	50
2006	14	Tent, Boot, Grout, Fabric	57	43
2007	5	Tent	80	20
2003-2007	64		44	56

The case report that follows describes the onset of chemical pneumonitis with marked hypoxia and bilateral radiographic evidence of diffuse airspace disease.

CASE REPORT

“A 55-year-old man with a history of hyperlipidemia, childhood asthma, and restless leg syndrome presented to the emergency department (ED) with fever, chills, dyspnea, fatigue, and dizziness. His past surgical history included an appendectomy and leg surgery after trauma several years ago. His social history was significant for pipe smoking, occasional ethanol use, and travel to Africa 4 months previously. He received malaria prophylaxis with mefloquine before and after this visit. The patient had no known drug allergies but had an egg and egg product allergy. The only medication prior to admission was atorvastatin. One day prior to admission the patient used a water-repellent spray on some raincoats in his garage. A short time after the administration of the aerosolized water repellent, the patient had episodes of nonproductive cough and felt feverish with chills. Later that night the patient felt nauseated upon awakening and had a syncopal episode with brief loss of consciousness in his bathroom. The next day he still felt feverish with chills, and had dyspnea, fatigue, and dizziness at which time his wife brought him to the ED. In the ED, his pO₂ was 49% and a chest X ray showed bilateral diffuse airspace disease. Soon afterwards, while sleeping, his O₂ saturation dropped to a nadir of 42%. His O₂ saturation improved to 90% with the use of a 100% nonrebreather mask. His temperature was 37.3°C, and respiratory rate 38 breaths/min. His lungs were remarkable for rhonchi in the mid-lung zone. Laboratory values were notable for a white blood cell count of 18.3 X 10³/mm³.”

“The patient was treated with methylprednisolone 125 mg intravenously (IV) in the ED and was admitted to the intensive care unit for oxygenation monitoring. Drug therapy in the intensive care unit included methylprednisolone 40 mg IV every 6 hours and azithromycin 500 mg IV/d. The patient required FiO₂ for 3 days at 40-80% Hi Flow to keep his oxygen saturation above 90%. On day 2 of hospitalization, repeat chest X ray showed improvement of airspace disease and the patient felt subjectively better. An echocardiogram showed preserved left ventricular function and no pericardial effusion. An electrocardiogram showed normal sinus rhythm and no ischemic changes. The patient was weaned off the oxygen on day 3 and had an uneventful recovery to discharge from the hospital on day 4”(6).

Since 1979 there have been fifteen reports of outbreaks of chemical pneumonitis associated with particular waterproofing products. Table II summarizes the nine reports written in English of outbreaks involving 962 patients. Additional outbreaks were reported in Germany in 1979 and 1983, Japan in 1992 and 1993, France in 1998 and the Netherlands in 2003. In the report from 5 states in 2005, the majority of the patients (54%) occurred in Michigan after the use of a waterproof spray for boots and shoes (11). There is also an unpublished report of 40 cases of lung disease after the use of a waterproof spray grout sealer (Children’s Hospital of Michigan Regional Poison Control Center).

The cases associated with waterproofing boots/shoes are more frequent in the winter (11). Generally people have become sick after using the products indoors. Half the cases involved family members in the household who had not actually used the product. Additionally, pets were reported with similar respiratory symptoms and radiograph changes (11). In some cases the exposure and illness occurred after the boots/shoes had been sprayed and were brought into the house (11). There was no evidence of substance abuse (11). Over 90% of the cases have occurred among consumers. The others have occurred in occupational settings. Generally effected individuals have not had risk factors for respiratory disease although 8% have had preexisting asthma and 18% have been cigarette smokers (11).

What is the mechanism for the toxicity of the waterproof spray and the reason for the intermittent presentation of the cases? The outbreaks have been blamed on a fluorinated resin and reformulation of the solvent used in

waterproofing spray since the solvent trichloroethane was banned for this use in the United States in 1994 and worldwide in 1995, although clearly cases have occurred before 1994. Animal studies show pulmonary hemorrhage and edema with exposure to the newly formulated products despite the fact that the fluoropolymer resins and solvents have differed among the products associated with outbreaks (12). The common chemical property may be particle size and solvent volatility that increase the amount inhaled rather than a particular resin or solvent (13). This hypothesized mechanism related to particle size, however, has been contradicted by a more recent study, with detailed sampling data, that ascribed the effect to the particular fluoropolymer resin (14). Further work is needed to determine what property of the waterproof spray is responsible and why only some products cause the lung disease.

Typically what has happened after recognition of an outbreak is that the manufacturer has stopped distribution of the product but the Consumer Product Safety Commission has not recalled the product that is already on the retail shelves. No regulatory agency has performed sufficient investigatory activity to promulgate regulations to prevent the formulation responsible for these lung problems from appearing on the market under a new brand name.

We are very interested in receiving reports of work or non work-related lung disease from exposure to waterproofing compounds. Call us at 1-800-446-7805 or email us at OD.report@msu.edu.

Table II. Summary of Outbreaks of Lung Disease Associated with Waterproofing Agents, Published in English				
Number of Patients	Location	Time Period	Use	Ref
550	17 States	1992	Leather Garments	1
38	2 States	1993	Shoes	2, 3
16	Quebec	1994	Shoes	4
1	Switzerland	1997	Skis	5
1	Connecticut	2001	Raincoats	6
180	Switzerland	2002-2003	Leather & Textiles	7, 8
3	Switzerland	2002	Floor Tiles	9
4	Scotland	2004-2005	Horse Rugs	10
172	5 States	2005	Boots/Shoes	11

Chemical Pneumonitis

Symptoms of respiratory distress may be immediate or have been reported to occur hours later. The severity of disease with chemical exposure is dose dependent with chemical pneumonitis the least severe lung presentation being the most common clinical presentation. More severe presentations include pulmonary edema or adult respiratory distress syndrome (ARDS). The clinical and histopathologic features of pneumonitis, pulmonary edema and ARDS caused by inhalation of a chemical does not differ from that caused by other sources. The clinical presentation includes dyspnea and cough either productive or non-productive. Patients may be febrile, have an elevated white count and have non-specific symptoms such as headache, fatigue and dizziness. Depending on severity, patients may be hypoxic, have restriction on ventilation, decreased diffusing capacity and diffuse bilateral infiltrates on chest radiograph.

Patients should be treated with supportive therapy, including oxygen and possibly mechanical ventilation. Although there are no controlled trials, patients generally receive corticosteroids. Because of uncertainty at the time of presentation many patients are cultured and receive antibiotics. Unlike pneumonia, the chest radiograph clears within days to weeks. Long term sequelae may include Reactive Airways Dysfunction Syndrome (RADS) with persistent wheezing and shortness of breath.

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*Project
S E.N.S.O.R.

News

Michigan State University
College of Human Medicine
117 West Fee Hall
East Lansing, MI 48824-1316
Phone (517) 353-1846

Address service requested.

In this issue:
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*PS Remember to report all cases of occupational disease!

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the Reporting of
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Michigan Occupational Safety &
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Management and Technical

Services Division

P.O. Box 30649

Lansing, MI 48909-8149

Reporting forms can be obtained by

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Project SENSOR Staff

*At the Michigan Occupational
Safety & Health Administration
(MIOSHA)*

Douglas J. Kalinowski, Director MIOSHA

Project SENSOR, Co-Director

John Peck, M.S., Director MTS Division

Byron Panasuk, C.I.H., C.S.P.

Project SENSOR Specialist

*At Michigan State University—
College of Human Medicine*

Kenneth D. Rosenman, M.D.

Professor of Medicine

Project SENSOR, Co-Director

Mary Jo Reilly, M.S.

Project SENSOR Coordinator

Amy Sims, B.S.

Project SENSOR NIHL Coordinator

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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.

(517) 353-1846

MSU-CHM

117 West Fee Hall

East Lansing, MI 48824-1316