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

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Swimming Pools and Asthma

Does swimming in chlorinated water cause or aggravate asthma (1)? Studies in children and elite Olympic swimmers have suggested a causal relationship between repeated swimming in chlorinated pools and the development of asthma (2 - 4). The "pool chlorine hypothesis" states that the increased incidence of asthma in developed countries is at least partially caused by children spending more time in chlorinated swimming pools. However, because many of the studies that find a risk of asthma in association with swimming are cross-sectional, an alternative explanation is that people with asthma are more likely to swim because this form of exercise has, at least in the past, been recommended for individuals with asthma (1). For example, in support of the absence of a causal relationship between asthma and swimming in a chlorinated pool, a longitudinal study from birth of 14,541 children from the United Kingdom found that children who swam were less likely to have asthma at ages 7 and 10 (5). However, an accompanying editorial questioned the findings of this study by suggesting that the exposure assessment used for time spent swimming was inadequate and that these data did not negate findings that older adolescents and elite swimmers have a high prevalence of bronchial reactivity (6, 7). The risk of asthma from swimming is still under active investigation. This newsletter will examine the data concerning pool workers and asthma.

Case Summary of Respiratory Problems in a Michigan Lifeguard

A woman in her twenties developed shortness of breath three years after beginning to work as a lifeguard at an indoor water park in Michigan. She was begun on albuterol and a steroid inhaler. Her symptoms improved away from work. She found different work in an office setting and her symptoms resolved except when she swims recreationally, which she limits to about an hour per week. She currently uses albuterol only in association with swimming and has completely stopped using the inhaled steroid. She is a nonsmoker. She has a history of allergies and there is a family history of asthma. Before working at the water park she had been a lifeguard at a YMCA and a school. She had been treated once in the emergency department after having an acute exacerbation of her respiratory symptoms when the ventilation broke down at the water park.

Fifteen of the lifeguards at the water park completed a questionnaire during an OSHA inspection. In addition to the index case, one of the other lifeguards had been diagnosed with asthma. That person and four other lifeguards were bothered at work by daily or weekly symptoms of shortness of breath, chest tightness or wheezing. It was recommended that these five individuals have further medical evaluation.

OSHA was unable to sample for chloramines and chlorine air levels were within the allowable standards. OSHA made recommendations to reduce the likelihood of chlorine exposure in the room where chlorine was added to the pool water and to increase the ventilation in the areas where the lifeguards were assigned to stand.

The exposures of concern from swimming pools are the elevated air levels of chlorinated compounds found in indoor pools and water parks. Cloramine (chloramide), dichloramine (chlorimide) and trichloramine (nitrogen chloride) are formed when chlorine, added to the pool water to disinfect swimming pools, interacts with the nitrogen in the water from human sweat and urine. Also dichloramine may already be in the water used to fill the pool because many municipal water supplies are now using dichloramine as an alternative to chlorine because dichloramine-treated water has improved taste, is less likely to dissipate from the water and is less likely to convert organic material in the water to carbon tetrachloride or chloroform. Trichloramine is the most volatile of the three compounds and predominates at PHs less than 8. Mono and dichloramine, which are less volatile, are likely to be released from droplets when the water surface is disturbed (i.e. splashing, water park attractions).

Seven studies have been identified in the medical literature involving respiratory symptoms in pool workers, one of which from England included specific antigen challenge testing on three pool workers. In the report from England, two lifeguards and a swimming instructor developed occupational asthma and were tested with specific antigen challenge testing (8). The swimming instructor was a 42 year old woman who after ten years of work developed wheeze, chest tightness, breathlessness, sore eyes, a dry throat and recurrent chest infections. Symptoms started within two hours of starting work and were better on days away from work. Her symptoms resolved when she was away from work for three months but reoccurred when she returned to work. She had positive skin tests to environmental allergens. She had never smoked cigarettes. A histamine challenge test was negative. She had a positive peak flow test in relation to work and a positive specific antigen challenge test to trichloramine with an early and late response but a negative response to a specific antigen challenge test with chlorine. The second case was a 33 year old atopic female who developed wheeze, chest tightness, dry throat and sore eyes 14 years after beginning work as a lifeguard. She began waking up at night symptomatic which only improved when she was away from work. She had had asthma until the age of 11 with no respiratory problems again until she was 33. When she was reassigned to the library her symptoms resolved except for occasional chest tightness in the morning and she was able to stop her asthma medication. She had never smoked. She had a positive histamine challenge test. She had a positive peak flow test in relationship to work as a lifeguard and a positive early response to a specific antigen challenge with trichloramine and a negative result with challenge to chlorine. Case 3 was a 49 year old male lifeguard who 12 years after beginning work developed cough and wheezing after a respiratory tract infection. He was an ex-smoker. When his symptoms began he reacted in multiple situations to multiple irritants. He was non atopic. He subsequently had an acute asthma attack ten minutes after being poolside. He then retired and only reported breathlessness when walking uphill. He was unable to complete peak flow testing because he became too breathless in the pool area. He had a positive specific antigen challenge test to trichloramine. A control patient with occupational asthma from formaldehyde also responded to trichloramine but to a smaller decrease in FEV_1 than his response to formaldehyde.

The other studies have been cross-sectional respiratory studies of swimming pool personnel. These studies have been conducted in France (9), Italy (10), the Netherlands (11), Sweden (12), Switzerland (13) and the United States (14). All these studies have shown increased ocular and upper respiratory symptoms and all but the French and Swiss study (9, 13) found increased lower respiratory symptoms in individuals who work at pools. Some studies found a correlation between symptoms and exposure levels of trichloramine (11-13). None of these cross sectional studies performed peak flow or spirometric measures in association with work.

OSHA has a workplace standard of 1 part per million for chlorine but no standard for any of the chloramine compounds. The World Health Organization has recommended a standard of 0.5 mg/m^3 for trichloramine, based on the studies showing an association between an increasing prevalence of eye, nasal and respiratory irritation and increasing air levels of trichloramine. A study of 30 indoor pools in Switzerland recommended allowable levels of trichloramine be no higher than 0.2-0.3 mg/m^3 (14). There are 24 water parks in Michigan. Cases of asthma in lifeguards and other pool personnel have been identified from two of them. We are interested in hearing from you if you have patients with asthma that are possibly related to work at a water park or pool. Please call Kenneth D. Rosenman, M.D., 1-800 -446-7805, if you have patients whose asthma is associated with working at a water park or pool.

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