

# Swimming Pool–Induced Asthma

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## ■ Abstract

A 13-year-old elite swimmer presented with wheezing after indoor swimming training. On the basis of her clinical history and the tests performed, exercise-induced asthma and mold-induced asthma were ruled out and a diagnosis of chlorine-induced asthma was made.

Key words: Chlorine. Asthma. Children.

## ■ Resumen

Una nadadora de élite de 13 años de edad refirió sibilancias tras un entrenamiento de natación en una piscina cubierta. Basándose en sus antecedentes y en las pruebas realizadas, se descartó el asma inducida por el ejercicio físico y por moho y se diagnosticó asma inducida por cloro.

Palabras clave: Cloro. Asma. Niños.

## Introduction

Chlorination, the most commonly used method for ensuring water hygiene in swimming pools, has potentially harmful effects on the respiratory tract and could play a role in the rising numbers of children and adolescents with asthma. We report the case of an adolescent girl with chlorine-induced asthma.

## Case Description

A 13-year-old white girl attended the emergency room with dyspnea, wheezing, paresthesia, and chest pain after 2 hours of indoor swimming training. The patient denied fever and flu-like symptoms. She had a history of hay fever without asthma, but no history of heart disease. She had been training in indoor swimming pools as a competitive swimmer 3 times a week since the age of 6, and was a nonsmoker. Physical examination revealed mild respiratory distress, and chest examination revealed tachypnea and mild diffuse wheezing. The results of cardiac, neurological, and musculoskeletal examinations were normal. Arterial blood pressure was 115/60 mmHg, peripheral oxygen saturation breathing room air was 95%, and arterial blood gas evaluation revealed a pH of 7.44, Pco<sub>2</sub> of 35 mmHg, and Po<sub>2</sub> of 80 mmHg. The results of blood tests were negative.

Bronchoconstriction diminished after inhalation of 400 µg of salbutamol. The patient was discharged with a presumptive diagnosis of hyperventilation syndrome, exercise-induced asthma, and/or mold-induced asthma. We prescribed 400 µg of salbutamol 20 minutes before every training session.

Despite prophylactic treatment with salbutamol, the patient presented a few days later with dyspnea and wheezing that, once again, had occurred during her training session at an indoor pool.

We decided to perform routine skin prick tests with inhalant allergens, as well as basic and exercise spirometry in the outpatient department. These tests were performed under normal conditions and did not reveal obstructive pulmonary disease. The skin prick tests confirmed her known grass and tree pollen allergy and ruled out sensitization to epithelia, house dust mite, and, especially, mold, which could be present in indoor swimming pools and responsible for bronchoconstriction. Evidence from her clinical history and the tests performed enabled us to rule out exercise-induced asthma and mold-induced asthma; therefore, we assumed that her bronchoconstriction was chlorine-induced. We recommended training in a nonchlorinated swimming pool. At her follow-up evaluation, 2 months after she had switched to a nonchlorinated swimming pool, the patient did not report any wheezing during her training sessions.

## Discussion

Swimming is often recommended to children as a sport with a low potential for exercise-induced asthma, since the humid environment of the swimming pool is considered to protect against exercise-induced bronchoconstriction [1,2]. However, in the last few years, the effects of chronic lung exposure to chlorine and its byproducts have aroused increasing interest. Chlorination, the most commonly used method for ensuring water hygiene in swimming pools, is potentially harmful to the respiratory tract. Irritant gases and aerosols contaminating the air of indoor swimming pools, chlorination products present in pool water, or even aerosols and vapors floating at the surface of outdoor pools can affect the pulmonary epithelium and increase asthma risk in children and adolescents [3,4]. The immediate effects of chlorine gas toxicity include inflammation of the conjunctiva, nose, pharynx, larynx, trachea, and bronchi. Irritation of airway mucosa leads to local edema secondary to active arterial and capillary hyperemia and congestion, without mast cell degranulation [5]. Continued exposure seems to produce effects further into the respiratory system, to the extent that the structure and integrity of bronchioles and alveoli may be lost. These changes manifest as a loss of respiratory function due to obstruction [6]. The pool chlorine hypothesis has been postulated, that is, increasing exposure to the harmful by-products of chlorination might contribute to the rising numbers of children with asthma [7,8]. Different studies have confirmed the detrimental effects of pool chlorine on the respiratory tract [9-11], and attending chlorinated pools during childhood can increase the risk of atopic diseases (asthma, allergic rhinitis, and hay fever) [7,12,13]. Few studies confirm or challenge the pool chlorine hypothesis, and there is only 1 report that children living in a home cleaned with chlorine bleach had a lower prevalence of asthma [14]. Nevertheless, we must remember that children are in direct contact with the chlorinated products (eg, gases, aerosols, water). A study involving adolescent elite swimmers in Scotland assessed the combined effect of chlorine and exercise on the airways, but did not reveal involvement of surrogate markers of inflammation [15].

Although noninvasive and specific tests to characterize the irritating effects of chlorine on the airways are not available, our patient benefited enormously from avoiding a chlorinated swimming pool.

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