Monika Franczuk

Lung Function Department, Institute of Tuberculosis and Lung Diseases in Warsaw
Head: Prof. S. Wesołowski, MD, PhD

Recognition of exercise-induced bronchoconstriction — a task for a medal

Rozpoznawanie powysiłkowego skurczu oskrzeli — zadanie na medal

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A physiological response to exercise leads to increased ventilation, which is an adaptive mechanism related to increased body demand for oxygen and accelerated metabolism. Maintaining constant blood gasometry parameters is the main task of the breathing control system. Increased respiratory drive and intensified activity of respiratory muscles lead to increased tidal volume. During strenuous physical exercise, when this volume reaches the level of approximately 70-75% of total lung capacity, breathing frequency is also significantly higher. In poorly trained individuals, intense breathing may be interpreted as a pathological symptom, dyspnoea, especially if it impairs normal functioning and causes respiratory discomfort and considerable fatigue. On the other hand, diseases of the respiratory system such as chronic obstructive pulmonary disease or pulmonary fibrosis are accompanied by impaired exercise tolerance, resulting in the need to reduce the intensity of effort. These are immanent features of disease progression and impaired lung function.

A specific clinical situation is the occurrence of dyspnoea and respiratory symptoms during or after strenuous physical exercise. Exercise-induced bronchoconstriction (EIB) is a term for transient constriction of the airways leading to impaired air flow and symptoms such as cough, wheezing, or dyspnoea, which appear during strenuous physical exercise or, more frequently, after its discontinuation. A delayed reaction, which occurs less often, refers to a bronchospasm that appears 3 to 8 hours after exercise. The pathogenesis of this phenomenon is not fully understood. Intense exertion and increased ventilation cause water loss and increased osmolarity of airway mucus [1]. Through the activation of mast cells, epithelial cells, eosinophils, stimulation of nervous endings, and release of numerous inflammatory mediators, histamine, prostaglandins, or leukotrienes it results in constriction of bronchial smooth muscle, mucosal oedema, and increased vascular permeability. According to another theory, called thermic or vascular, the main role is played by exposure to cool air, which contributes to vasoconstriction preventing heat loss. Discontinuation of exercise and reduction of ventilation cause vasodilation, congestion, and mucosal oedema, resulting in narrowing of the bronchi and restricted air flow. It seems that exercise-induced bronchoconstriction is a result of both mechanisms.

Exercise-induced bronchoconstriction may occur in patients with diagnosed asthma; up to 90% of patients report exercise-induced symptoms [2]. It usually indicates insufficient disease control and the necessity of treatment modification. Exercise-induced bronchoconstriction also affects 10-15% of the general population, including individuals without a history of asthma or atopy. EIB is significantly more frequent in sportsmen, especial-

Correspondence address: Monika Franczuk, MD, PhD, Lung Function Department, Institute of Tuberculosis and Lung Diseases in Warsaw, Płocka 26 St., 01–138 Warszawa, e-mail: m.franczuk@igichp.edu.pl

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ly professionals taking part in competitive sports like cycling, long-distance running, swimming, and winter sports such as cross-country skiing or speed skating. Among these athletes, EIB symptoms have been observed in 50-70% of individuals [3-6]. A review of the results of recently published studies indicates that EIB mechanism in this population may also be related to alternating processes of damage and repair in the bronchial epithelium, induced by repeated hyperventilation and increased exposure to dry, cool, and polluted air [7].

The literature and guidelines regarding EIB treatment emphasize the role of proper diagnosis. The data from anamnesis, based on symptoms reported by the patients, have been considered as definitely insufficient for diagnosis and inappropriate for initiation of treatment [8]. It has also been emphasized that, due to mechanisms contributing to EIB that are slightly different than those in asthmatic patients, non-specific provocation tests with histamine or methacholine have a limited diagnostic value. Despite numerous studies, it has not been clearly established which method would show the features of a „gold standard" in diagnosing EIB.

The currently recommended method of diagnosing EIB, accepted and required by the International Olympic Committee and World Anti-Doping Agency, is exercise challenge testing. It should be noted that it is not equivalent to the stair climbing test or 6-minute-walk test used in diagnosing and monitoring respiratory diseases. It is required that exercise challenge tests be performed under specific, controlled conditions. Protocols of recommended exercise tests have been discribed in detail by Hildebrand [7]. Diagnosis is based on the presence of bronchial obstruction induced by the stimulus, and decreased forced expiratory volume in 1 second (FEV_1) by at least 10% in relation to the baseline values.

An exercise challenge test, performed under the recommended conditions, is not commonly used due to costs and limited access to adequate equipment. Thus, other methods for diagnosing EIB are being considered, including eucapnic voluntary hyperventilation, mannitol challenge test, or exposure to hyper- and hypotonic aerosols. Other studies, also carried out by Polish investigators [9], are aimed at including into EIB diagnostics the measurement of nitric oxide concentration in exhaled air (FE_{NO}) or the evaluation of the concentration of eosinophil chemotactic agents in exhaled breath condensate (EBC).

In view of the above mentioned issues, the study carried out by Hildebrand et al. [10] has aroused a great deal of interest and appreciation. The authors investigated the issue of evaluating the usefulness of selected tests for EIB diagnosis. They methodically designed a study that included patients suffering from asthma, individuals reporting EIB symptoms, and healthy volunteers. The study protocol included: assessment of lung function, bronchial challenge test to methacholine and adenosine monophosphate (AMP), and exercise challenge tests. It was demonstrated that for the diagnosis of EIB the most valuable was a combination of typical symptoms (dyspnea, cough and wheezing after exercise) with positive results of AMP challenge test. The achieved results, characterised by high specificity (94%) and sensitivity (70%), may indicate a very promising diagnostic option for EIB, especially for patients reporting EIB symptoms without atopy or diagnosed asthma in anamnesis, in whom initiation of appropriate treatment may lead to significant improvement of quality of life and normal functioning.

The problem of exercise-induced bronchoconstriction, sometimes also called exercise induced asthma (EIA), has been known and investigated for several years. From time to time, especially in connection with international sports events, this issue is raised and becomes the subject of numerous discussions and controversies. Considerations are mainly focused on athletes with diagnosis of exercise-induced asthma, who are treated and achieve great results, confirmed by sporting awards. Many debates also concern the role of implemented treatment as a doping agent. On the other hand, epidemiological studies have demonstrated that EIB is one of the most important risk factors for sudden death in young professional sportsmen [11]. It has been pointed out that routine health assessment in sportsmen should include not only the cardio-vascular system, but also the respiratory system, with special focus on diagnosing asthma and EIB. It is also very important that the teams taking care of athletes, i.e. coaches, instructors, and sports medicine doctors, should be aware of the higher risk of EIB in professional sportsmen practising „asthmogenic" disciplines (especially winter sports), and its possible symptoms and diagnostic tools.

Therefore, it is very important to precisely prepare and consequently follow diagnostic criteria for EIB, and to establish indications for its pharmacotherapy.. The importance of the AMP challenge test, as described in the results of Hildebrand et al. [10], might be very useful; therefore, such studies should be continued and confirmed in larger groups of subjects.

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