

Editorial

Asthma, allergy, the athlete and the Olympics

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As the 2008 Summer Olympics in Beijing approach, both the general public and health care professionals are gaining interest in the potential health implications of sport. When asthma and allergy are present in athletes, this may affect their performance and achievements and justify the special attention of health care professionals who specialize in taking care of top athletes. However, the impact of allergy and asthma on sport and exercise goes further than just top athletes. The Editors of *Allergy* decided that in this issue they would focus the attention of allergy and asthma specialists by presenting a series of articles on the relationship between sport, asthma and allergy in the hope that an increased awareness of these problems would be highlighted not only for sports medicine doctors but also for all practicing allergists.

Exercise-induced asthma (EIA) is a general concern for growing children and adolescents. In most international guidelines, one of the main objectives of treating asthma during childhood is for the child to be able to master EIA. Also among athletes, and especially elite athletes, EIA and bronchial hyperresponsiveness (BHR) have become major problems with regard to the correct diagnosis and to treatment. EIA is increasingly common among the top athletes of several different types of sport. Traditionally this has been reported mainly in athletes competing in endurance sports in cold climates, especially among cross-country skiers (1, 2) and swimmers (3, 4), but also among

endurance athletes in summer sports (5). A surprisingly high prevalence of asthma (56%) diagnosed by the reversibility of lung function to inhaled β_2 -agonists (56%) was reported among professional Canadian football players (6). The prevalence of EIA among top athletes has increased over the past decades. Weiler et al. reported 11% prevalence of EIA among American athletes participating in the 1984 Summer Olympic Games (7) and an increase to a prevalence of more than 20% was noticed among American participants in the 1996 Summer Olympic Games in Atlanta (8).

Severe asthma among athletes

Treating asthma and EIA in top athletes might seem a trivial matter and perhaps a luxury, given that athletes usually master physical performance better than most of us. However, even athletes need an optimal diagnosis and treatment for their asthma. This has been demonstrated by Becker et al. who reported deaths linked to athletic performance over a 7-year period in the USA (9). Out of 263 deaths, 61 were asthma related. Among those occurring in competitive athletes, 51% occurred while participating in organized sports. Only one of the 61 athletes used inhaled steroids (9). Thus, optimal asthma treatment is a must among competitive athletes.

Pathogenetic mechanisms

Two hypotheses attempt to explain the relationship between physical activity and EIA. One relates to cooling of the airways because of increased ventilation during exercise, the other because of an increased loss of water from the respiratory tract, also caused by increased ventilation during exercise. Airway cooling because of respiratory heat loss during the increased ventilation in exercise is thought to cause vasoconstriction in bronchial vessels followed by a secondary reactive hyperemia with resulting edema and airways narrowing (10). Secondly, there is substantial evidence that EIA is effected through the release of mediators from mast cells and other inflammatory cells of the airways. This is thought to be caused by the high ventilation rates of top athletes (up to >280 l/min) during exercise with a considerable water loss due to the saturation of inhaled air with water. The cause of mediator release is the change in osmolality of the periciliary fluid lining the respiratory mucosal membranes (11). The effectiveness of inhaled mannitol as a tool to diagnose BHR further confirms this hypothesis (12).

Why do athletes develop asthma and bronchial hyperresponsiveness?

The first observation that high intensive exercise may cause an increase in BHR was made in Norwegian competitive swimmers in whom the BHR increased after a swimming exercise of 3000 m (3) and then in young skiing athletes during the competitive season (13). Heavy endurance training, especially when performed in an unfavorable environment, presents stress to the mucosal membrane of the airways. This was shown by Sue Chu et al. in bronchial biopsies from highly-trained young skiers without asthma but with increased airways responsiveness to cold air (14, 15). They described an increased airways inflammation with lymphoid aggregates and an increased tenascin expression (as measured through the thickness of the tenascin-specific immunoreactivity band in the basement membrane) in the skiers (14, 15). Similar findings were recently described experimentally comparing exercising and sedentary mice (16). Furthermore, inflammatory changes in induced sputum were reported among competitive swimmers (4).

Thus, intense and repeated physical endurance training over prolonged periods of time in combination with nonoptimal environmental conditions may contribute to the development of asthma and BHR among top athletes.

The environment

Endurance training and competition in unfortunate environmental conditions are thought to contribute to the development of BHR among top athletes. Examples

are the development of BHR and EIA among cross-country skiers (1, 2) and among competitive swimmers (4). Larsson showed that cold air inhalation increased the number of inflammatory cells in broncho alveolar lavage (17). In children, Bernard et al. found a relationship between the time spent in swimming pools during early childhood and the development of asthma as well as signs of lung involvement by increased serum levels of surfactant proteins (18) and reduced levels of Clara cell protein (19). Also, respiratory tract infections increase bronchial responsiveness in actively training athletes (20).

Thus, the combination of intense and repeated exercise with unfavorable environmental conditions is probably important for the development of asthma among top athletes.

Concern about exercise-induced asthma, bronchial hyperresponsiveness, the use of asthma drugs and performance in elite athletes

Despite epidemiological evidence regarding the increased prevalence of EIA and BHR among top athletes, frequent use of asthma drugs leads to concern about the possible improvement in performance by asthma drugs and especially by inhaled β_2 -agonists. Thus, already in 1993, the Medical Commission of the International Olympic Committee (IOC-MC) set restrictions for the use of asthma drugs in sports. Among the β_2 -agonists, salbutamol and terbutaline were permitted, and only by the inhaled route. Athletes with a confirmed diagnosis of asthma were allowed to use these drugs. Later, these regulations were changed several times. Shortly before the Salt Lake City Winter Olympic Games in 2002, the IOC-MC introduced new rules for the use of inhaled β_2 -agonists and inhaled steroids during the Games (21). Applications had to be determined beforehand and the results of laboratory tests such as exercise tests, bronchial provocation tests with metacholine, eucapnic hyper ventilation tests or documented reversibility to inhaled β_2 -agonists had to be submitted (21). Several allergologists and pulmonologists felt that these rules were too strict as they focused upon the specificity of the asthma diagnosis and not upon the sensitivity (22). As a result, a joint Task Force was set up by the European Respiratory Society (ERS) and the European Academy of Allergology and Clinical Immunology (EAACI). This task force has worked on several articles related to asthma and sport, which were published as a European Respiratory Monograph (23). The report of the Task Force reviewed the problem of asthma among athletes as well as the pathogenetic mechanisms and provided recommendations related to the diagnosis of asthma and BHR and to asthma treatment among athletes. The Task Force report is published in two parts in *Allergy*. The first part, published in this issue, discusses epidemiology, pathogenetic mechanisms and the diagnosis of asthma among

athletes, whereas the second part will provide recommendations related to treatment and will discuss questions regarding doping. As the regulations for the use of asthma drugs among athletes have been repeatedly changed, physicians treating asthmatic athletes and children and adolescents with asthma should keep themselves updated on the current regulations. This may be done by consulting the World Antidoping Association website (<http://www.wada-ama.org/en/t1.asp>; accessed 22 January 2008) or, with regard to the Olympic games, the IOC website (http://www.olympic.org/uk/utilities/reports/level2_uk.asp?HEAD2=1&HEAD1=1; accessed 22 January 2008).

The work initiated by the Task Force has been continued by the Global Asthma and Allergy European Network (GA²LEN), the European network of centers of excellence in allergy. The work package within this network related to asthma, allergy and sports has decided to carry out a European study related to the prevalence and diagnosis of asthma among athletes. Several European countries will participate in this project, which is a co-operation between GA²LEN and the National Olympic Committees of the participating countries.

Allergies, allergic sensitization and sport

In addition to asthma (which is not always allergic), other allergic disorders like allergic rhinitis or atopic eczema have been observed as common among elite athletes. In Australian Olympic athletes, 29% suffered from allergic rhinoconjunctivitis and 41% had positive skin tests to at least one aeroallergen (24). Allergic athletes experience symptoms of upper and lower airway disease on exposure to both outdoor and indoor aeroallergens, which may significantly decrease their physical performance (25). Furthermore, athletes with hay fever have significantly more exercise-related airway symptoms. Sensitization to alleroallergens may be particularly important during the Olympic Games, which usually take place during the peak

of the pollen season. As demonstrated during the Olympic Games in Athens, pollen monitoring may help allergic athletes to achieve peak performance under prophylactic measures (<http://www.aeroallergen.gr>). The presence of atopic sensitization seems to be a risk factor for the development of bronchial hyperreactivity and asthma among athletes (26). From a practical point of view, these observations strongly suggest that WHO-ARIA recommendations to investigate all asthmatic subjects for rhinitis and patients with rhinitis for asthma should also be applied to elite athletes.

Another phenomenon, which is not yet well explored, is the association of physical exercise with the development of allergic sensitization. Competitive swimmers had a higher incidence of allergic diseases and subclinical sensitization to common allergens (27). Moreover, chlorinated pool attendance by children was associated with an increased risk of the development of bronchial asthma but also of hay fever (28). On the other hand, the physical activity of children may be a protective factor for the development of asthma (29). The combination of these observations should prompt further studies on the relationship between various forms of physical activity and allergic sensitization.

Starting with this issue, Allergy will publish a series of articles aiming to review the relationship between asthma, allergy and sport and to help solve problems related to these interactions. As already mentioned, the ERS/EAACI Task Force Report will be published in two parts, and other articles, either review articles or systematic reviews, will take on questions such as the prevalence of asthma and EIA among athletes, diagnostic procedures and questions related to the use of asthma drugs and athletic performance. This is an important series as problems related to sport will be of interest to most allergists/pulmonologists and their patients. The issue is also of significance because asthma drugs should not be considered as doping, and young people should not stop using their asthma drugs because of questions related to doping.

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