**Allergic rhinoconjunctivitis in athletes — mechanisms of impaired performance and implications for management**

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**ABSTRACT**

Allergic rhinitis and conjunctivitis are the most common clinical manifestations of allergic disorders in the athletic population, and are probably under-diagnosed and under-treated in athletes. While some of the manifestations of allergic rhinitis are not difficult to diagnose, the signs and symptoms in athletes can be quite subtle. The more subtle clinical presentation in athletes might include poor quality sleep, fatigue or reduced exercise performance; the mechanisms underlying these effects are explained. While the diagnosis of allergic rhinitis in the athlete is primarily made on the grounds of the history and physical examination alone, assessment of specific IgE through skin or laboratory tests is an important tool in the diagnosis and should be considered part of the periodic health assessment of the athlete. Prevention and management strategies should be used by the medical team working with elite athletes and are discussed; however care should be taken to consider the World Anti-Doping Agency Code when managing elite level athletes.

**INTRODUCTION**

Allergic disorders are among the most common medical conditions in athletes and non-athletes alike.1 Allergic rhinitis, conjunctivitis, skin conditions and bronchoconstriction (asthma) are the main presenting clinical manifestations of these allergic disorders. Although asthma and rhinitis often coexist,1 2 a significant proportion of athletes suffer from allergic rhinitis without symptoms of asthma, yet have increased bronchial hyper-reactivity during bronchial challenge tests. Exercise-induced bronchoconstriction (EIB) is covered elsewhere in this edition of the journal; the main focus of this article addresses allergic rhinitis and rhinoconjunctivitis in the athlete.

**EPIDEMIOLOGY**

The prevalence of allergy has been increasing steadily over the last 20 years, yet the reasons for this increase remain unclear.3 4 Allergic rhinitis alone can affect between 20% and 40% of the non-exercising population. Peak age of presentation of allergic rhinitis is between 6 and 25 years old. This includes the age range of most elite athletes.

Our interest in atopy and athletes began in response to a need for a preparation programme for the Sydney 2000 Olympic Games, which took place in spring. We undertook a study to identify athletes in the South African team who were at risk of developing symptoms of atopy during the competition. The further aim of this study was to offer therapeutic advice and prophylactic medications to those athletes found to be at risk. A total of 93 athletes from 8 different sporting codes took part in the study, which included a questionnaire, physical examination and skin-prick testing.5

Results of the study are shown in Table I.

<table>
<thead>
<tr>
<th></th>
<th>Cape Town</th>
<th>Durban</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atopic based on SPT</td>
<td>50.5%</td>
<td>50%</td>
<td>50.5%</td>
</tr>
<tr>
<td>Seasonal allergic rhinitis</td>
<td>21.4%</td>
<td>7%</td>
<td>15.7%</td>
</tr>
<tr>
<td>Persistent allergic rhinitis (HDM)</td>
<td>7.5%</td>
<td>13%</td>
<td>10%</td>
</tr>
<tr>
<td>Seasonal and persistent allergic rhinitis</td>
<td>21%</td>
<td>30%</td>
<td>25.5%</td>
</tr>
<tr>
<td>Asthma</td>
<td>11%</td>
<td>15%</td>
<td>13%</td>
</tr>
</tbody>
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SPT – skin prick test; HDM – house dust mite.

The percentage of athletes found to be atopic was 50.5%; 21.5% of the athletes had evidence of seasonal allergic rhinitis and/or conjunctivitis. Another 21.5% of the athletes had evidence of both seasonal allergic rhinitis and perennial allergic rhinitis. The majority of the allergies were to grass pollens and house-dust mite. Of concern were the findings that many of the athletes had no knowledge as to which allergens they were allergic and that these allergies could adversely affect their performance. Furthermore, many of the athletes were unaware that medication could be used to manage their symptoms.

Subsequent results of epidemiological studies of allergy and atopy in athletes from other countries have also yielded interesting information. Studies have indeed documented that allergic rhinitis7 and allergic rhinoconjunctivitis8,9 are more common in athletes than currently thought, and these conditions are probably under-diagnosed and undertreated in athletes.10 In one study, 16.8% of Swiss athletes from different sports were reported to suffer from rhinitis, with 59% of the athletes requiring medication during the pollen season to control symptoms.11 In this study, it was also reported that the athletes with rhinitis also had significantly more exercise-related respiratory tract symptoms (RTS). In another study among elite athletes preparing...
for the Olympic Games in 2000, 56% of athletes gave a history consistent with allergic rhinoconjunctivitis. 41% had a positive skin-test response to any one allergen and 29% reported seasonal allergic conjunctivitis. 9,12 In a retrospective analysis of medical records of the 1976 and 1980 Australian Olympic teams the prevalence of allergic disorders in athletes was reported as 20%.13

There appears to be a difference in the prevalence of allergic conditions among the different sports, with aquatic sports (swimming, rowing and diving) showing a higher risk of allergic rhinitis than non-aquatic sports.14 Paradoxically, equestrians have the lowest atopic tendencies, probably due to natural selection.8

The prevalence of allergies, in particular allergic rhinitis in endurance athletes was recently reported in two studies. In one study among elite athletes preparing for the 2004 Olympic Games, 18.3% of the athletes reported allergies, with 14.5% reporting allergic rhinitis. In this study, there were no gender differences, but endurance athletes reported a higher prevalence of allergies than other subgroups.15 In a recently published survey among 261 male and 185 female athletes participating in different sports, the prevalence of a ‘disturbing allergy was 32.1%, with the highest prevalence in aquatic sports (43.5% of athletes). This prevalence of allergies in athletes was higher than that reported for the normal population (20%). Furthermore, 26.5% of all athletes, and 36.1% of endurance athletes reported allergic rhinitis. In this survey, the prevalence of all allergies and allergic rhinitis was similar in male and female athletes. A recent study of young soccer players has shown a 34.5% prevalence of allergic diseases in contrast to 31.6% in the control group.16

In summary, there is evidence that allergies are common in elite athletes with the prevalence of any allergy varying between 16% and 56%. Allergic rhinoconjunctivitis appears to be one of the most common allergic conditions in all athletes (26-56% of athletes). Finally, recent data indicate that endurance athletes have a higher prevalence of allergic conditions (32% of athletes), and more specifically allergic rhinitis (44% of athletes).

CLINICAL MANIFESTATIONS OF ALLERGIC RHINITIS AND RHINOCONJUNCTIVITIS IN ATHLETES

While some of the manifestations of allergic rhinitis are not difficult to diagnose, sometimes the signs and symptoms in athletes can be quite subtle. The clinical signs and symptoms of allergic rhinitis are listed in Table II. The typical clinical presentation includes nasal congestion, sneezing, rhinorrhea, postnasal drip, cough and itching of the nose, mouth, and throat. The clinical presentation is often associated with the symptoms and signs of allergic conjunctivitis, namely redness, swelling, tearing, and itching of the eyes with photophobia occurring on occasion. The more subtle clinical presentation in athletes might include poor quality sleep, fatigue or reduced exercise performance.17

More recently a presentation of rhinitis, namely exercise-induced rhinitis, has been described. It is characterised by itching, sneezing, rhinorrhea, postnasal drip, nasal congestion and occasional anosmia. This clinical picture is typically provoked by exercise. The rhinitis is often accompanied by conjunctival, ear or throat symptoms.1,18

The diagnosis of allergic rhinitis in the athlete is primarily made on the grounds of the history and physical examination alone. Assessment of specific IgE through skin or laboratory tests is an important tool in the diagnosis. Exercise-associated rhinitis can be confirmed by special investigations in the form of exercise provocation tests, including determination of nasal obstruction (nasal peak flow, rhinomanometry and acoustic rhinometry), and tests of mucus clearance. These exercise tests are however currently not standardised nor validated as diagnostic tools.18

It is important that the presence of rhinitis makes the physician aware of the strong possibility of concomitant asthma/EIB in the athlete, and the athlete should be investigated accordingly.19,20

PATHOPHYSIOLOGY OF ALLERGIC RHINITIS IN ATHLETES

Outdoor athletes, including long-distance runners, track and field athletes, cyclists, swimmers and athletes from certain team sports, have increased exposure to airborne allergens especially during seasons or periods with high pollen (or pollution) counts.9,12,21

Following exposure to the allergens, oedema of the nasal mucosa occurs as a result of IgE-mediated release of both early- and late-phase mediators, including the Th2 cytokines. These mediators cause inflammatory cell infiltration of the nasal mucosa. It has been suggested that during the above process, mucociliary clearance becomes dysfunctional and can result in subtle airways obstruction. A direct consequence of the nasal obstruction is mouth breathing.22 This is disadvantageous for two reasons. Firstly, allergens and other pollutants are not filtered out by the nose; thus increased concentrations are deposited in the lower airways.23 Secondly, air warming and humidification is reduced. This results in cooling of the lower airways and bronchial hyperreactivity.23,24 Furthermore, the consequences of nasal obstruction leads to mouth breathing contributes to airways dysfunction in other ways. With the unified airway model of asthma, the immune response, once induced, does not differentiate between nasal and respiratory tissue, thus the initiation of the immunological cascade in the nose may lead to a direct or indirect immune response in the lungs.25,27

Postnasal drip which is caused by allergic rhinitis can also affect the function of the vocal chords. This is particularly evident during exercise, as the body temperature increases and the viscosity of the mucus reduces, allowing it to flow onto the vocal chords, with a reflex increase in bronchial hyperreactivity.28

EFFECTS OF ALLERGIC RHINITIS ON EXERCISE PERFORMANCE

The potential negative effects of allergies on training and performance in athletes have not been well studied. To our knowledge, there are no studies that have
used established physiological performance variables to measure the effects of allergic conditions on exercise performance. There are anecdotal reports, which are not confirmed by physiological measures, that Olympic athletes with severe exacerbations of allergic conditions have suboptimal exercise performance.\textsuperscript{4,5} It is also known that rhinitis often causes changes in sleep patterns as a result of nasal obstruction, rhinorrhea and sinus pressure,\textsuperscript{6} and the resultant tiredness and fatigue could impair athletic performance.\textsuperscript{2} Furthermore, the anxiety and depression that can accompany allergic rhinitis can pose a threat to athletic performance. It has also been postulated that the release of pro-inflammatory cytokines and endotoxins with subsequent activation of the hypothalamic pituitary axis and ensuing cortisol release might be responsible for the decrease in athletic performance.\textsuperscript{17}

Allergic rhinitis and nasal obstruction can potentially have a negative effect on exercise performance through altered airflow dynamics and ventilation during exercise, particularly during high-intensity activities. Short bouts of sprinting depend on nasal breathing for optimal performance, and nasal obstruction that is associated with allergic rhinitis may inhibit this mechanism.\textsuperscript{7}

Allergic rhinitis has also been associated with alterations in central nervous system function, which may significantly impair athletic performance. Reaction time, attention and vigilance were decreased during cognitive processing tests, when subjects suffering from allergic rhinitis were exposed to pollen.\textsuperscript{17} Headache, mouth breathing, rhinorrhea and itchiness of the ears, nose or throat may all have a direct impact on an athlete participating in a precision-based sport.

Sleep disorders, increased fatigue during the waking hours and reduced cognitive function including reduced reaction time, attention and vigilance have been noted when susceptible individuals are exposed to pollen.\textsuperscript{28}

**MANAGEMENT OF ALLERGIC RHINITIS IN ATHLETES**

Prevention and management strategies should be used by the medical team working with elite athletes and have been reviewed previously.\textsuperscript{8,11,17,27,30-33} Prior knowledge of the seasonal allergen types and counts, pollutants, temperatures and humidity will allow the athlete to prepare fully for competition.\textsuperscript{21} However, allergic avoidance strategies are not always practical for the athlete who exercises in the outdoor setting. Allergy testing should be included as part of the preseason medical evaluation of the athlete. This will identify the athlete at risk and allow time for prophylaxis. We therefore suggest that this evaluation could be conducted as part of the periodic health assessment of the athlete, at least on one occasion.

Management of allergic conjunctivitis includes allergen avoidance (when possible) and direct treatment with antihistamine, corticosteroid or mast cell stabiliser eye drops. Saline irrigation of the nose is effective in reducing the allergens in contact with the nasal mucosa. The use of external nasal dilator strips seems effective in increasing the nasal diameter and can have a positive effect on exercise performance.\textsuperscript{39}

Intranasal corticosteroids remain the most successful therapy for reduction of moderate to severe symptoms and improvement in sleep quality, in both allergic and non-allergic rhinitis.\textsuperscript{36} Intranasal corticosteroids are not prohibited and require neither a Therapeutic Use Exemption (TUE) nor a Declaration of Use. Systemic corticosteroid use (oral, intravenous, intramuscular or rectal routes) however, is prohibited in competitive athletes, and use of these agents would require a TUE application to be completed and approved by the authorities (forms available from www.wada-ama.org).

Oral second-generation antihistamines are important agents effective in the relief of symptoms of allergic rhinitis.\textsuperscript{5} These newer agents do not have the central nervous system side-effects (sedation) associated with the first-generation agents and are not prohibited by the World Anti-Doping Agency (WADA).

Leukotriene receptor antagonists may also be beneficial in treating allergic rhinitis, particularly when it coexists with asthma. Although it is not recognised or proposed as good standard medical management of allergic rhinitis, some team physicians still use vasoconstrictors to acutely manage athletes with rhinitis as a form of quick-fix to allow the athlete to compete without strained breathing patterns and to allow the athlete to breathe through the nose at night. Oral and intranasal alpha-adrenergic agonists are vasoconstrictors and thus effective decongestants, but may cause insomnia, loss of appetite and rebound nasal congestion.\textsuperscript{37} It is important to note that the use of ephedrine-containing formulations (by any route of administration) is prohibited in competitive athletes. Furthermore, the regulations concerning pseudoephedrine have changed this year. Pseudoephedrine is now included on the 2010 Prohibited List as a specified stimulant prohibited ‘In-Competition’ at a urinary threshold of 150 μg/ml. Given the wide availability of pseudoephedrine-containing medicines it is important that the physician is aware that the established threshold levels may be reached (rarely, but possibly) by some individuals within 6-20 hours of intake of some long-lasting therapeutic formulations. It is therefore important that the treating physician should advise athletes to stop taking pseudoephedrine-containing medications at least 24 hours before participation.

During the ‘In-Competition’ period, the use of alternative permitted medications is suggested or application for a TUE for the use of pseudoephedrine for therapeutic purposes. (Download forms from www.wada-ama.org).

Allergen immunotherapy has not been specifically researched in the athletic population, yet is effective management in the non-athletic population. Athletes with severe or persistent symptoms should be referred to allergy specialists for further evaluation for allergen immunotherapy.\textsuperscript{38}

**Declaration of conflict of interest**

The authors declare no conflict of interest.

**REFERENCES**

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