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João Pedro Carvalho Araújo

Prospective assessment of a questionnaire
to assess asthma in athletes

Abril, 2010

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Faculdade de Medicina da Universidade do Porto, 20/04/2010

Assinatura: João Araújo

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Faculdade de Medicina da Universidade do Porto, 20/04/2010

Assinatura: 

Prospective assessment of a questionnaire to assess asthma in athletes

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Cover

Under the proposed of integrated masters and in additon to this work I also participated over these 3 years as a coauthor in the following studies:

Effect of continuing or finishing swimming on airway inflammation and atopy-related diseases: a 3-year prospective follow-up study of competitive swimmers.

Patrícia Andrade¹, Marta Pereira¹, João Araújo¹, Pedro Moreira, Patrícia Padrão, João Fonseca², Luis Delgado^{1,2}, André Moreira ^{1,2}

Is competitive swimming associated with increased airway inflammation?

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Abstract

Asthma is diagnosed more frequently in elite athletes than in general population, however regardless of these high and growing prevalence allergy diagnosis is often unnoticed in sports medicine.

We aimed to determine the specificity, sensitivity, and feasibility of using a questionnaire to identify athlete's asthma.

A cross-sectional study was conducted in a convenience sample of 29 non-smoking athletes, with and without asthma, to assess the performance on the diagnosis of asthma. To assess the validity of the study we used the crostabulation test between the diagnosis of asthma based on questionnaire and the final medical diagnosis of asthma according with the World AntiDoping Agency criteria. A second prospective study with 23 different athletes was performed to assess the reproducibility of the questionnaire. Subjects completed the self-administered questionnaire which was repeated 2 weeks later. To assess test–retest reliability of responses, we used the kappa (κ) statistic.

Although high specificity and positive predictive value was observed, sensitivity and negative predictive value was low. Kappa values are between considerable and moderated.

Even though our questionnaire showed to be reliable it performed poorly to screen asthma in athletes.

Background and aim

Asthma is diagnosed more frequently in elite athletes than in the general population [1]. Pathogenesis has been attributed to an exercise and irritant induced airway inflammation and airway hyperresponsiveness [2], which have attenuated after discontinuing training and competition [3]. Atopy and type of sports appear to be the two major risk factors with atopic swimmers having a 97-fold increased risk of asthma diagnosis compared to non-atopic non-athletes [1]. Regardless of the high and growing prevalence of allergic diseases in athletes, allergy diagnosis is often unnoticed in sports medicine.

Asthma has always been a clinical diagnosis, recognized on the basis of a characteristic history of variable wheezing, cough, and breathlessness and supported by objective evidence of variations in airflow. In Portugal, only electrocardiogram and clinical history are required as part of the routine examination for athletes determining eligibility to compete. Therefore, concern exists regarding the underdiagnosis and undertreatment of asthma in athletes.

Currently, Portuguese national guidelines for asthma diagnosis require similar procedures as the ones set by the International Olympic Committee to document exercise induced in athletes. The process demands demonstration of airway obstruction, or airway hyperresponsiveness additionally to a clinical history compatible with the diagnosis. All together, procedure is time consuming and expensive making it unfeasible for asthma screening in all athletes.

There is the need of a simple, reliable screening tool for asthma in athletes sensitive enough to detect the majority of subjects at risk but not so sensitive that makes its application impossible in a nationwide perspective. To our knowledge only one asthma questionnaire designed for athletes has undergone formal validation in a putative high risk population [4]. Although the AQUA questionnaire showed a good correlation with allergy, the gold standard for diagnosis was allergy measured by skin prick tests.

In our study, we aimed to determine the specificity, sensitivity, and feasibility of using a questionnaire to identify athlete's asthma .

Methods

A cross-sectional study was conducted in a convenience sample of non-smoking athletes, with and without asthma, to assess the performance on the diagnosis of asthma (**Validation study**). A second prospective study with different athletes was performed to assess the reproducibility of the questionnaire (**Reproducibility study**). Written informed consent was obtained for each subject or their parent before entering the study. The local hospital ethical committee approved the study.

Questionnaire validation

A total of 29 athletes were included (Table 1). Subjects completed a self-administered questionnaire, including 5 questions adapted from ISAAC questionnaire, reporting allergic symptoms, asthma, physician diagnosis of asthma and asthma medication. Spirometry was performed using a calibrated,

computerized pneumotachograph spirometer (SensorMedics Vmax 22, SensorMedics, Yorba Linda, USA) according to ATS recommendations. Bronchial responsiveness (BHR) was assessed by metacholine challenge test performed according to recommendations. As a gold standard for asthma diagnosis we used the world antidoping agency criteria asthma which defines asthma as syndrome of the respiratory airways typified by recurrent episodic symptoms. These may include variable airflow obstruction that is reversible (either spontaneously or with treatment), the presence of airway hyper-reactivity and chronic airway inflammation. Therefore medical history with respiratory symptoms and: 1) a rise in FEV1 to bronchodilator $\geq 12\%$ and 200 ml; or 2) a fall in FEV1 $\geq 20\%$ in response to methacholine and a PD20 $\leq 2\mu\text{mol}$ in those not taking inhaled corticosteroids (ICS) or a PD20 $\leq 8\mu\text{mol}$ in those taking ICS for at least one month were used as gold-standard for the diagnosis. To assess the validity of the study we used the cross-tabulation test between the diagnosis of asthma based on questionnaire and the final medical diagnosis of asthma.

Prospective assessment

A total of 23 athletes were included in this part of the study (Table 1). Subjects completed the self-administered questionnaire which was repeated 2 weeks later. To assess test–retest reliability of responses, we used the kappa (κ) statistic (Table 3), comparing the responses of the following variables: allergy, asthma, rhinitis, other allergies (eczema, conjunctivitis, mites, pollens, animals, fungi, food and drugs).

Results

Sensitivity, specificity, positive and negative predictive value of the questions related to asthma and rhinitis diagnosis are presented in table 2. Although high specificity and positive predictive value was observed, sensitivity was low both both for asthma and rhinitis questions. Concerning the reliability, all Kappa values are between considerable and moderated. The best correlation was found in 'asthma' (K 0.776) and 'other allergies' with results falling within the moderate parameter (K 0.649). Rhinitis and allergies had values inside the considerable parameter.

Discussion

It is well recognized that questionnaire based definitions of asthma may not necessarily correspond to the clinical definition of asthma. Even though our questionnaire-based diagnosis showed to be reliable it performed poorly a screening tool for asthma in athletes. The use of self-reported diagnosis in this population yielded high frequencies of false negative results. Diagnosis should include assessment of lung function coupled with airway hyperresponsiveness in combination with the athlete's history of asthma symptoms at the least.

Our study has several limitations. We used self reported diagnosis of asthma instead of a composite definition including different asthma symptoms such as chest tightens or wheezing. However symptoms, as it has been shown, do not correlate with asthma diagnosis in athletes [5]. We used a limited number of subjects in the validation study and all were swimmers. Although methacholine

challenge testing was selected as the “gold standard” for asthma, it is well known that airway hyperresponsiveness is present in a certain proportion of asymptomatic persons without asthma, which could affect the specificity of our questionnaire. Also, during the first administration of the questionnaire, we have performed skin prick tests and exhaled nitric oxide (data not shown) which may have influenced the perception to the diagnosis increasing the awareness and making so that in the second questionnaire, particularly those relating to allergies, the Kappa statistic was affected.

The AQUA questionnaire was recently adapted to nonprofessional exercisers. It proved to be a useful tool for calling attention to the high prevalence of allergy in exercisers and might provide the initial step toward developing flowcharts for allergy diagnosis in sports medicine [4]. Also, AQUA questionnaire showed the importance of identifying early allergy in athletes. Diagnosing allergy may also help with the early identification of mild forms of bronchial obstruction or rhinoconjunctivitis that, although often not reported by athletes, may still influence optimal physical performance [4].

Additionally (data not shown) we measured exhaled nitric oxide in swimmers using a portable device. Previous studies have shown exhaled nitric oxide to assess a specific domain of the asthma syndrome [6]. Future studies should assess the cost-effectiveness of this easy to use non-invasive airway inflammation tool as a screening for asthma diagnosis in this set of subjects.

In conclusion, our study provides support to the usefulness of questionnaires to screen asthma in athletes. Diagnosis should include objective assessment of lung function coupled with airway hyperresponsiveness in combination with the athlete's history of asthma symptoms at the least. Further studies should assess the use of exhaled nitric oxide in this population as a screening instrument.

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Table 1. Characteristics of the athletes

	Questionnaire validation, n=29	Prospective assessment, n=23
Age	16±2	16±1
Gender, female/male	9/20	11/12
Swimming hours/week	18 (8)	14 (4)
Years of competition	6 (5)	7 (3)

Data presented as median (IQR) unless otherwise stated

Table 2. Sensitivity, specificity, positive and negative predictive value of the questions related to asthma and rhinitis diagnosis

Questions	Se	Sp	PPV	NPV
Physician diagnosis of asthma	43%	100%	100%	83%
Physician diagnosis of allergic rhinitis	33%	92%	83%	52%

Se – sensitivity; Sp – specificity; PPV – positive predictive value; NPV – negative predictive value

Table 3. Values of Kappa statistic to assess the reproducibility of the questionnaire in the 23 athletes included

	Baseline, Yes/No	Follow up Yes/No	Kappa
Asthma	3/20	2/20*	0.776
Other allergies	9/14	11/12	0.649
Rhinitis	5/18	5/18	0.489
Allergy	12/11	10/13	0.481
Kappa values: 0-0.20 slight; 0.21-0.40 considerable; 0.41-0.60 moderate; 0.61-0.80 substantial; 0.81-1 excellent. * n=22			

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