Sensitization to House Dust Mites: Association with Airway Hyperresponsiveness in Mite-Sensitive Young Adults with Asthma

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Background: The aim of this study was to evaluate the correlation between sensitization to mite and airway hyperresponsiveness in mite-sensitive young adults with asthma.

Methods: This study included 72 young male Korean conscripts aged between 19 and 30 years who complained of recurrent wheezing and dyspnea with nocturnal aggravation and no history of other lung disease, asthma exacerbation, or treatment against asthma except short-acting beta2 agonists over the last 2 months. They underwent pulmonary function tests and methacholine challenge tests. In 63 subjects, the forced expiratory volume in 1 second was more than 60% of the predicted value, and the provocative concentration of methacholine causing a 20% decline in forced expiratory volume in 1 second in 63 subjects was less than 16 mg/mL. Serum was collected from these subjects to measure specific immunoglobulin E against Dermatophagoides farinae and Dermatophagoides pteronyssinus using the AdvanSure Allergy Screen test.

Results: Specific immunoglobulin E against Dermatophagoides farinae and Dermatophagoides pteronyssinus correlated negatively with provocative concentration of methacholine causing a 20% decline in forced expiratory volume in 1 second in 50 subjects who were mite-sensitive (γ = −0.368, P=0.009; and γ = −0.415, P=0.003, respectively). However, specific immunoglobulin E against Dermatophagoides farinae and Dermatophagoides pteronyssinus was not correlated with forced vital capacity, forced expiratory volume in 1 second, or forced expiratory volume in 1 second/fused vital capacity.

Conclusion: Sensitization to mites may correlated with airway hyperresponsiveness in mite-sensitive young adults with asthma. (Korean J Asthma Allergy Clin Immunol 2012; 32:183-189)

Key words: Asthma; Dermatophagoides farinae; Dermatophagoides pteronyssinus; Sensitization

INTRODUCTION

Sensitization to house-dust mites (HDM) including Dermatophagoides farinae (Df) and D. pteronyssinus (Dp) is a significant and independent risk factor for the development of asthma in areas where HDM proliferate.1,2 Moreover, exposure to mite allergens is related to the severity of asthma.3,4

Asthma is a chronic inflammatory airway disease characterized by airway hyperresponsiveness (AHR) and reversible airflow obstruction.5 With regard to the relationship between asthma and sensitization to mites, AHR is sensitive to changes in exposure to relevant allergens.6,7 Thus, in individuals with a genetic predisposition who live in an area with sufficient HDM proliferation, exposure to mite allergens can result in sensitization, followed by the development of AHR and subsequent asthma.1,10 However, previous studies have reported that the degree of AHR was not correlated with the degree of sensitization to mite allergens.11,13 In a community-based study, allergy to HDM was associated with reduced lung-function parameters including forced expiratory volume in 1 second (FEV1) and the ratio of FEV1 to vital capacity.14,15 However, the relationship between sensitization to mite allergen and reduced lung function has been controversial in studies of asthmatic patients.16-18

The prevalence of wheezing, a classic symptom of asthma, among young conscripts in the Korean military has been reported to be 10.5%, and the prevalence of current asthma in one area of the
military was estimated to be 9.1%. The authors suggested that a family history of allergic disease, overweight, current smoking, current allergic rhinoconjunctivitis, and current eczema were risk factors for wheezing. However, the study did not evaluate whether sensitization to aeroallergens including HDM could be a risk factor for asthma symptoms because a skin-prick test and measurement of serum specific immunoglobulin E (IgE) against aeroallergens were not performed.

The present study aimed to evaluate the relationship between sensitization to the HDM allergen and AHR in mite-sensitive young adults with asthma in the Korean military.

MATERIALS AND METHODS

1. Subjects

We recruited young male Korean military conscripts aged from 19 years to 30 years who visited Armed Forces Capital Hospital complaining of recurrent wheezing and dyspnea with nocturnal aggravation who had no history of other airway or lung disease, asthma exacerbation and who had not received treatment against asthma within last 2 months, with the exception of short-acting beta2 agonist (SABA). All participants provided informed consent. Participants were requested to complete a questionnaire regarding smoking status and the existence of combined allergic rhinitis, which have been associated with AHR.

2. Study design

After recruitment, the participants underwent a basal pulmonary function test (PFT) and a subsequent methacholine challenge test (MCT). The parameters of the basal PFT included forced vital capacity (FVC), FEV1, and FEV1/FVC. Subjects with severe airway obstruction whose FEV1 was less than 60% of the predicted value were excluded before the MCT. AHR was defined as a provocative concentration of methacholine causing a 20% decline in FEV1 (PC20) in the MCT < 16 mg/mL, and subjects with AHR were included as asthma patients. Serum was collected to measure the level of specific IgE against inhalant allergens including Df and Dp. Subjects in whom specific IgE against Df or Dp was class I or higher (> 0.35 IU/mL) were enrolled in the study to evaluate the relationship between sensitization to HDM and AHR.

3. Pulmonary function test

PFT was performed using a Sensor Medic 2130 (SensorMedics Corporation, Yorba Linda, CA, USA). FVC and FEV1 were recorded according to American Thoracic Society (ATS) recommendations. The higher of two values for FEV1 (reproducible within 100 mL) was recorded and percentages of predicted FEV1 values were calculated.

4. Methacholine challenge test

The MCT was conducted using dosimeter method, as the ATS guidelines recommended. Briefly, methacholine was inhaled during inspiration using an automatic nebulizing device (NE-U17; Omron, Kyoto, Japan) and dosimeter (NSPIRE; Longmont, CO, USA) until a PC20 was obtained or a concentration of 16 mg/mL was reached. Subjects were requested not to use SABA on the day of MCT.

5. Measurement of specific IgE against inhalant allergen

Serum-specific IgE against Df and Dp was measured using the AdvanSure Allergy Screen (LG Life Science, Seoul, Korea). The degree of sensitization against Df and Dp were graded from class 0 to class VI according to the titer of serum-specific IgE against Df and Dp (class 0: 0.00~0.34 IU/mL, class 1: 0.35~0.69 IU/mL, class 2: 0.70~3.49 IU/mL, class 3: 3.50~17.49 IU/mL, class 4: 17.50~49.99 IU/mL, class 5: 50.00~99.99 IU/mL, class 6: ≥100 IU/mL).

6. Statistical analysis

The correlations between specific IgE against Df and Dp and the other continuous variables were evaluated using Spearman’s rank correlation coefficient. PC20 was compared according to smoking status and the existence of combined allergic rhinitis using Kruskal-Wallis test and Mann-Whitney U-test, respectively. The statistical analyses were performed using the Statistical Package for the Social Sciences software (SPSS ver. 12.0, SPSS Inc., Chicago, IL, USA). A P value < 0.05 was deemed to indicate statistical significance.

7. Ethics statement

The research protocol was approved by the ethics committee of the Armed Forces Medical Command (ROK-MND-2009-KMMRP-015).

RESULTS

1. Demographic and clinical characteristics of subjects

A total of 72 subjects complaining of recurrent wheezing and