Analysis of PAI-1 gene polymorphism of dust mite allergens in children

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ABSTRACT

Objective: To explore PAI-1 gene polymorphism of dust mite allergens in children. Methods: A total of 160 allergic children who were admitted in our hospital from June, 2013 to June, 2015 were included in the study and performed with the dust mite allergy test, among which 80 cases with the positive results were served as the observation group, while 80 healthy children with the negative results were served as the control group. ASPCR was used to analyze PAI-1 gene polymorphism. ELISA was used to detect the content of plasma PAI-1. Results: The detection of genotype frequency goodness fit showed that the genotypes in the two groups reached Hardy-Weinberg balance. PAI-1 4G/4G genotype carrying frequency in the observation group was significantly higher than that in the control group \((P<0.05)\). 5G/5G genotype carrying frequency in the observation group was significantly lower than that in the control group \((P<0.05)\), while 4G allele carrying frequency was significantly higher than that in the control group \((P<0.05)\). The content of plasma PAI-1 in the observation group with 4G/4G was significantly higher than that in patients with 4G/5G and 5G/5G. Conclusions: PAI-1 gene polymorphism is probably the risk factor for dust mite allergy. Deep insight of the structure and function of PAI-1 can guide the clinician to prevent and intervene the dust mite allergy in children.

1. Introduction

Dust mites are the tiny microorganisms commonly existing in people’s life, and can be seen under the microscope due to their extremely small volume. The dust mites are numerous in variety. The researches in recent years show that dust mites is closely associated with the allergic diseases and is an important allergen, among which Dermatophagoides farinae, Dermatophagoides pteronyssinus, and Euroglyphus maynei can lead to human allergy. These dust mites are surviving in the human living environments and are extremely easy to be inhaled by the human to cause allergic reactions. The common allergic reactions include allergic rhinitis, allergic asthma, allergic conjunctivitis, and urticaria[1]. The allergic reaction is associated with heredity, and is a concurrent result of heredity gene and environment. The study is aimed to analyze PAI-1 gene polymorphism of dust mite allergens in children.

2. Materials and methods

2.1. General materials

A total of 160 allergic children who were admitted in our hospital from June, 2013 to June, 2015 were included in the study and performed with the dust mite allergy test, among which 80 cases with the positive results were served as the observation group, while 80 healthy children with the negative results were served as the control group. In the observation group, the children were aged from 2 to 6 years old, with an average age of \((4.8\pm2.1)\) years old, among which 38 were male, and 42 were female, 26 had allergic asthma, 14 had allergic rhinitis, 22 had urticaria, 18 had allergic...
conjunctivitis, and were diagnosed with dust mite allergy by allergen detection. In the control group, the children were aged from 1 to 6 years old, with an average age of (4.4±1.5) years old, among which 45 were male, and 35 were female. The comparison of the general materials between the two groups was not statistically significant ($P>0.05$). The control test could be performed and the specific analysis was shown in Table 1. An informed consent was obtained from the children’s patients, and the study was approved by the related departments in the study.

### 2.2.2. Analysis of PAI-1 gene polymorphism

ASPCR was used to analyze PAI-1 gene polymorphism. ELISA was used to detect the content of plasma PAI-1.

### 2.2.3 PAI-1 gene detection methods

A volume of 5mL morning fasting venous blood was collected from the children in the two groups. The anti-coagulation was done. The blood was centrifuged at 2,000 r/min for 10 min. The upper plasma was taken. ELISA kits (USCNLIFE, USA) was used. ELIASA was used to detect OD value. The content of PAI-1 in the samples was calculated.

### 2.3. Statistical analysis

SPSS 11.0 software was used for statistical analysis. The $t$ test was used for the comparison of the measurement data. Chi-square test was used for the comparison for allele frequency or genotype frequency between the two groups. $P<0.05$ was regarded as statistically significant.

### 3. Results

#### 3.1. Distribution of PAI-1 genotype and allele frequency

The detection of genotype frequency goodness fit showed that the genotypes in the two groups reached Hardy-Weinberg balance. PAI-1 4G/4G genotype carrying frequency in the observation group was significantly higher than that in the control group ($P<0.05$). 5G/5G genotype carrying frequency in the observation group was significantly lower than that in the control group ($P<0.05$), while 4G allele carrying frequency was significantly higher than that in the control group ($P<0.05$) (Table 2).

#### 3.2. Comparison of the serum PAI-1 level

The plasma PAI-1 level in the observation group was significantly higher than that in the control group ($P<0.05$). The content of plasma PAI-1 in the observation group with 4G/4G was significantly higher than that in patients with 4G/5G and 5G/5G ($P<0.05$) (Table 3).

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**Table 1**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Number</th>
<th>Skin prick test results</th>
<th>Mediwise sensitive screening test results</th>
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</thead>
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<tr>
<td></td>
<td></td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td>Observation group</td>
<td>80</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>Control group</td>
<td>80</td>
<td>0</td>
<td>80</td>
</tr>
<tr>
<td>Statistical value</td>
<td></td>
<td>12.609 5</td>
<td>12.609 5</td>
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<tr>
<td>$P$ value</td>
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<td>0.000 0</td>
<td>0.000 0</td>
</tr>
</tbody>
</table>

**Table 2**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Number</th>
<th>Genotype carrying frequency [n(%)]</th>
<th>Allele frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4G/4G</td>
<td>4G/5G</td>
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<tr>
<td>Control group</td>
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<td>40(50.00)</td>
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<td>33(41.25)</td>
<td>27(33.75)</td>
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<tr>
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<td>2.076 6</td>
</tr>
<tr>
<td>$P$ value</td>
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<td>0.006 5</td>
<td>0.037 8</td>
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**Table 3**

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<th>PAI-1</th>
<th>$t$</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4G/4G</td>
<td>4G/5G</td>
<td>5G/5G</td>
<td></td>
</tr>
<tr>
<td>Observation group</td>
<td>80</td>
<td>85.3±10.9</td>
<td>90.2±8.7</td>
<td>83.1±10.5</td>
<td>80.6±8.3</td>
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<td>Control group</td>
<td>80</td>
<td>32.5±2.3</td>
<td>33.0±2.9</td>
<td>30.4±4.3</td>
<td>31.2±3.7</td>
</tr>
<tr>
<td>$t$</td>
<td>42.392 9</td>
<td>55.788 3</td>
<td>41.543 1</td>
<td>48.622 2</td>
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<tr>
<td>$P$ value</td>
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4. Discussion

Dust mite is one of the most common inhaled allergens in our daily life, is a kind of small type mite distributed all over the world, characterized by tiny volume and wide varieties, extensively surviving in our rooms and living environments, and can be seen under the microscope due to their tiny volume. The dust mites are numerous in variety. The researches in recent years show that dust mite is closely associated with the allergic diseases and is an important allergen, among which Dermatophagoides farinae, Dermatophagoides pteronyssinus, and Euroglyphus maynei can lead to human allergy. These dust mites are surviving in the human living environments and are extremely easy to be inhaled by the human to cause allergic reactions. The common allergic reactions include allergic rhinitis, allergic asthma, allergic conjunctivitis, and urticaria. Some investigations show that the most perennial allergic rhinitis occurs before 20 years old, among which about 70% are preschool children[2]. Therefore, prevention of allergic asthma is of great significance in the clinic. The researches demonstrate that the allergic reaction has a preference to heredity, and is concurrent result of heredity and environment. With an increasing morbidity of allergy, it receives more and more attention by people.

PAI-1 is a kind of serine proteinase inhibitors, is also an inhibitor of tPA, and is a main inhibiting factor of fibrinolytic system, whose structure is similar to the family members in the other serine proteinase inhibitors, and is transcribed by PAI-1[4-7]. Its encoding gene is located in the 1.3 to 2 band, long arm 2 area, no. 7 chromosome, including 9 exons and 8 introns. It is reported that PAI-1 has 8 polymorphic sites, among which the upstream 675 bp of PAI-1 gene transcription initiation site has an insertion or deficiency site of single guanine, with manifestations of the polymorphism and F VII gene R353Q polymorphism with the coronary heart disease. Chin J Gerontol 2014; 34(23): 6571-6573.

The results in the study showed that PAI-1 4G/4G genotype carrying frequency in the observation group was significantly higher than that in the control group (P<0.05). 5G/5G genotype carrying frequency in the observation group was significantly lower than that in the control group (P<0.05), while 4G allele carrying frequency was significantly higher than that in the control group (P<0.05). The content of plasma PAI-1 in the observation group with 4G/4G was significantly higher than that in patients with 4G/5G and 5G/5G.

In conclusion, PAI-1 gene polymorphism is probably the risk factor for dust mite allergy. Deep insight of the structure and function of PAI-1 can guide the clinician to prevent and intervene the dust mite allergy in children.

References