The influence of Astragali on the interleukin, IFN-γ and Th1Th2 balance in rats with airway inflammation.

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Abstract

Objective: To explore the influence of Astragali on the interleukin, IFN-γ and Th1Th2 balance in rats with airway inflammation.

Methods: The blank group, model group, Astragali group, Angelica group and compatibility group were relatively set and the method of drug gavage treatment of rats with allergic inflammation was used. Inflammatory model of rats was induced by ovalbumin spray method and interleukin, IFN-γ and Th1Th2 balance were observed in serum, lung tissue and nasal mucosa of rats.

Results: IFN-γ level decreased in the lung tissue, nasal mucosa and serum of rats in the model group, while interleukin increased, and related indicators of lung tissue and nasal mucosa had a certain relevance; single Astragali had the function of reducing IFN-γ level of nasal mucosa and serum as well as reducing interleukin in serum and lung tissue; single Angelica had the function of decreasing interleukin in the nasal mucosa, serum and lung tissue. The compatibility of Astragali and Angelica could elevate IFN-γ level in the serum and lung tissue as well as reduce interleukin in the nasal mucosa, serum and lung tissues.

Conclusion: The compatibility of Astragali and Angelica plays a regulatory role in balancing the two cytokines Th1 and Th2 in the body, functioning in suppressing allergic airway inflammation.

Keywords: Angelica, Astragalus, Airway inflammation.

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Introduction

The allergic airway inflammation in the clinic often presents as bronchial asthma (BR) and allergic rhinitis (AR), which is a type I allergic reaction, and means a kind of inflammation reaction due to the allergen inducing [1]. Allergic airway inflammation is formed because of the broken balance of Th1Th2, and Th1Th2 respectively refers to types 1 and 2 of helper T cells [2]. And Huang et al. [3] reported that the TT genotypes of the IL-4 gene at the -33 and -589 loci were associated with bronchial asthma susceptibility in children. Polymorphisms in IL-4 were associated with allergic rhinitis and could change the clinical picture of the disease in patients [4]. In addition, a recent study suggested that [5] the serum level of IL-2 and IL-4 could be perceived as a marker of severe bronchial asthma. Related research showed that the signal transducting system was involved in the process of PM2.5 promoting airway inflammation in rats which played the key role on the occurrence of the disease [6]. Angelica and Astragali are two drugs frequently used in allergic diseases in clinic. Astragalus polysaccharide (APS) the main active ingredient in Astragali, which could effect on the Toll-like receptor 4 (TLR4) of B cell and macrophage membrane, and has many functions such as immunoregulation [7]. Shao et al. [7] reported for the first time that APS directly interacted with TLR4 molecule. But the influence of Astragali on the interleukin, IFN-γ and Th1Th2 balance in airway inflammation is not clear. This paper studied the influence of Astragali on the interleukin, IFN-γ and Th1Th2 balance in rats with airway inflammation, and conducted corresponding reports.

Materials and Methods

Experimental grouping

50 clean grade and healthy Sprague-Dawley (SD) rats were chosen with body weight 120 ± 10 g and gender of male. They were randomly divided into 5 groups, respectively as the blank group, model group, Astragali group, Angelica group and the compatibility group. This research was approved by the Animal Ethical Committee of medical college of Qinghai university according to "Principles of Laboratory Animal Care" (NIH publication no. 85-23, revised 1985).

Experimental pharmacy

Aluminium Hydroxide Gel (sigma Co.), OVA (V level, sigma Co.), EnVision reagent (Dako, Denmark), interleukin-4 Kit (Dr. De biological engineering company in Wuhan), IFN-γ kit (Invitrogen), a resistance (America, Cruz, Santa), Astragali, Leguminosae Mongolia, Huangqi, batch number: 091211,
Results

**Comparison analysis of different drugs’ influence on interleukin and IFN-γ in nasal mucosa**

Comparing the model group and other groups, there was no significant difference in the expression of IFN-γ in nasal mucosa except Astragli group with no statistical significance (P>0.05); compared to model group, the expression of interleukin in nasal mucosa of blank group was significantly reduced with statistical significance (P<0.05); comparing with the model group, ratio of IFN-γ/IL-4 and the expression in blank group increased significantly with statistical significance (P<0.05, Table 1).

**Table 1. Comparison analysis of different drugs’ influence on interleukin and IFN-γ in nasal mucosa.**

<table>
<thead>
<tr>
<th>Group</th>
<th>IFN-γ</th>
<th>IL-4</th>
<th>IFN-γ/IL-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blank group</td>
<td>828.38 ± 93.20</td>
<td>973.13 ± 81.94</td>
<td>0.85 ± 0.12</td>
</tr>
<tr>
<td>Model group</td>
<td>709.28 ± 124.61</td>
<td>1424.38 ± 248.21</td>
<td>0.50 ± 0.07</td>
</tr>
<tr>
<td>Astragli group</td>
<td>838.87 ± 86.38</td>
<td>1333.40 ± 159.30</td>
<td>0.63 ± 0.10</td>
</tr>
<tr>
<td>Angelica group</td>
<td>808.56 ± 158.41</td>
<td>1022.28 ± 130.89</td>
<td>0.80 ± 0.21</td>
</tr>
<tr>
<td>Compatibility group</td>
<td>785.85 ± 100.45</td>
<td>906.06 ± 59.01</td>
<td>0.86 ± 0.15</td>
</tr>
</tbody>
</table>

Note: Comparing with blank group P<0.05, comparing with control group *P<0.05, and the same below.

**Comparison analysis of different drugs’ influence on interleukin and IFN-γ in lung tissue**

Comparing with model group, the expression of IFN-γ in blank group increased with statistically significant (P<0.05); there was significant difference in the expression of IFN-γ between compatibility group and model group with statistically significant (P<0.05); comparing with model group, the expression of interleukin in lung tissue of other groups was significantly decreased with statistical significance (P<0.05); ratio of IFN-γ and interleukin in lung tissue of the blank group was significantly higher than that of control group with statistical significance (P<0.05, Table 2).

**Table 2. Comparison analysis of different drugs’ influence on interleukin and IFN-γ in lung tissue.**

<table>
<thead>
<tr>
<th>Group</th>
<th>IFN-γ</th>
<th>IL-4</th>
<th>IFN-γ/IL-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blank group</td>
<td>980.67 ± 132.08</td>
<td>1124.62 ± 68.66</td>
<td>0.87 ± 0.13</td>
</tr>
<tr>
<td>Model group</td>
<td>801.41 ± 84.88</td>
<td>2306.76 ± 456.74</td>
<td>0.35 ± 0.09</td>
</tr>
<tr>
<td>Astragli group</td>
<td>905.66 ± 149.15</td>
<td>1914.80 ± 310.04</td>
<td>0.49 ± 0.06</td>
</tr>
<tr>
<td>Angelica group</td>
<td>795.13 ± 126.30</td>
<td>1939.07 ± 547.59</td>
<td>0.43 ± 0.13</td>
</tr>
</tbody>
</table>
The influence of Astragali on the interleukin, IFN-γ and Th1Th2 balance in rats with airway inflammation

Comparison analysis of different drugs’ influence on interleukin and IFN-γ in serum

Comparing with model group, the expression of IFN-γ in serum of blank group increased with statistically significant (P<0.05); there was significant difference in the expressions of IFN-γ between compatibility group and model group with statistically significant (P<0.05); comparing with model group, the expression of interleukin in serum of other groups was significantly decreased with statistical significance (P<0.05); ratio of IFN-γ and interleukin in serum of the blank group was significantly higher than that of control group with statistical significance (P<0.05, Table 3).

Table 3. Comparison analysis of different drugs’ influence on interleukin and IFN-γ in serum.

<table>
<thead>
<tr>
<th>Group</th>
<th>IFN-γ</th>
<th>IL-4</th>
<th>IFN-γ/IL-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blank group</td>
<td>81.7 ± 15.85</td>
<td>122.16 ± 46.54</td>
<td>0.75 ± 0.33</td>
</tr>
<tr>
<td>Model group</td>
<td>64.45 ± 6.16</td>
<td>284.44 ± 54.72</td>
<td>0.23 ± 0.05</td>
</tr>
<tr>
<td>Astragali group</td>
<td>87.07 ± 22.25</td>
<td>159.50 ± 48.30</td>
<td>0.60 ± 0.28</td>
</tr>
<tr>
<td>Angelica group</td>
<td>72.37 ± 12.42</td>
<td>229.53 ± 26.27</td>
<td>0.31 ± 0.04</td>
</tr>
<tr>
<td>Compatibility group</td>
<td>86.47 ± 17.43</td>
<td>144.30 ± 75.65</td>
<td>0.72 ± 0.30</td>
</tr>
</tbody>
</table>

Figure 1. Chemical structure of Astragalus polysaccharides.

Discussion

APS is the main active ingredient in Astragali and has been widely used in the clinical treatment of diseases of the allergic airway inflammation because of its extensive biological activities, such as anti-inflammatory [9], anti-carcinogenic [10], anti-virus [11] and immunomodulatory [12]. And the chemical structure of it was shown in Figure 1. Banche et al. [13] found that APS could effectively correct the imbalance of Th1/Th2 cells and reduce inflammatory infiltration in animal models of asthma. Recent study showed that intraperitoneal injection of APS could reduce the over expression of tumor necrosis factor (TNF)-α and IL-1β during experimental colitis induced by hapten [14]. And APS could enhance T lymphocyte transformation and activation of B lymphocytes and dendritic cells [15,16].

Th1 and Th2 are two kinds of cells playing different immune roles [17]. Th1 cells mainly reflects the cell immune, and when Th1 cells of the body have advantage, the body mainly presents proinflammatory, and clears various pathogens, which has obvious effect on the inhibition of infection in the body. Thus, it can build up chronic infection or improve the development of disease [18,19]. Th2 cells mainly reflect the humoral immunity, and when Th1 cells have advantage in the body, the body mainly presents anti-inflammatory. Thus, it can produce a variety of pathological product, as well as generally lead to various pathological changes [20,21].

In allergic airway inflammation, the balance of two kinds of cells as Th1 and Th2 moves toward the direction of the latter [22]. Only when the two kinds of cells as Th1 and Th2 are in a dynamic equilibrium state, can the body is able to show a healthy state. In addition, balance regulation on the two kinds of cells as Th1 and Th2 is also seen as an important aspect of body’s Yin and Yang balance regulation [23,24].

China’s traditional Chinese medicine believes that blood is the mother of Qi, and Qi is the commander of blood [25]. The principle for compatibility of Astragali and Angelica is blood and Qi simultaneous treatment, which is often used in clinic [26]. Not only can Astragali and Angelica be used as a prescription, but they also can be used as a kind of basic couplet medicines for combination use with other drugs, so the couplet medicines have received much attention from many doctors [27]. In addition, Astragali and Angelica are often used in the treatment of allergic airway diseases [28]. Relative research showed that Astragali could activate the body’s T cells and significantly activate and enhance the activation of lymphokine killer cell, the possible reason of which might be it would associate with the function of body related tonifying Qi [29]. Astragali can regulate the balance between the two kinds of cell factors as Th1 and Th2, improving the ventilation function of patients with asthma, and further reducing airway hyperresponsiveness.

This study showed that the IFN-γ in lung tissue, nasal mucosa and serum of rats in model group decreased, while interleukin increased, and related indicators of lung tissue and nasal mucosa had a certain relevance; single Astragali could reduce IFN-γ in nasal mucosa and serum as well as interleukin in lung tissue and serum; single Angelica could reduce interleukin in nasal mucosa, serum and lung tissues; Astragali and Angelica compatibility had the function of elevating IFN-γ in lung tissue and serum as well as reducing interleukin in nasal mucosa, serum and lung tissues.

In summary, Astragali and Angelica compatibility can play a role in regulating the balance on the two kinds of cell factors as Th1 and Th2 in the body, so that the balance moves toward the direction of Th1, then functioning in the inhibition of airway allergic inflammation.

References

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