Evaluation of serum enzymes polypeptide, chemokine levels and peripheral blood immune cells contents in children with bronchial asthma

Zhong-Yong Xie1*, Wei-Ming Chen1, Wei-Zhong Zhang1, Shang-Hong Tang2

1Department of Pediatrics, The First Maternal and Child Care Service Centre of Huizhou City, Huizhou Guangdong, 516001
2Department of Pediatrics, The People’s Center Hospital of Huizhou City, Huizhou Guangdong, 516001

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Abstract

Objective: To evaluate serum enzymes polypeptide, chemokine levels and peripheral blood immune cells contents of children with bronchial asthma. Methods: 150 bronchial asthma children were enrolled as observation group, 120 healthy children received physical examination in our hospital over the same period were enrolled as control group. Then serum enzymes polypeptide, chemokine levels and peripheral blood immune cells contents were detected. Results: (1) Enzyme polypeptide: serum Cat K, MMP1, MMP2, MMP9 contents of observation group were significant higher than those of the control group; but TIMP1 content was lower than that of control group; (2) Chemokine: serum Eotaxin, MCP-1, MCP-4, MDC and IL-8 contents of observation group were higher than those of the control group; (3) Immune cell: Th1 cell, CD4+CD25+ T cell and CD8+CD28+ T cell contents of observation group were significant lower than those of the control; but Th2 cells and Th17 cells were higher than those of control group. Conclusions: Serum enzymes polypeptide and chemokine levels of children with bronchial asthma abnormally increase with presence of peripheral blood T cell subsets contents disorder, which is correlated with airway remodeling and inflammatory cell infiltration process.

1. Introduction

Bronchial asthma is a chronic airway inflammatory disease with characteristics of irreversible airflow limitation and continuous airway hyper-responsiveness. In its occurrence and development process, airway remodeling and inflammatory cell infiltration are important pathological links. A variety of proteases and cytokines involve in the process of its pathological change. In clinical practice, reasonable and effective auxiliary examination ways are taken to accurately judge the illness condition and provide basis for treatment. Hematological index detection is the ideal auxiliary examination way with advantages of good repeatability and small influence from children’s coordination degree. Exploring hematological indexes related to bronchial asthma is always the hot spot of the field. Based on the knowledge of bronchial asthma mechanism, enzymes polypeptide, chemokines and immune cells are related to airway pathological changes. Therefore, in the following research, serum enzymes polypeptide, chemokine levels and peripheral blood immune cell contents of children with bronchial asthma were analyzed.

2. Materials and methods

2.1. Objects

A total of 150 children with bronchial asthma in our hospital from September 2012 to September 2014 were enrolled in observation group. All patients were first diagnosed of bronchial asthma and never received treatment of corticosteroids or bronchodilation
drugs. They were informed of research matters and signed informed consents. A total of 88 males and 62 females were included with age range of (8.12±0.95) years old. A total of 120 healthy children who received physical examination in our hospital over the same period were enrolled in control group. They were healthy and signed informed consents. A total of 90 males and 60 females were included with age range of (8.30±0.98) years old. There were no statistical differences in general data \( (P > 0.05) \).

### 2.2. Methods

#### 2.2.1. Specimen collection

Five mL of peripheral venous blood was collected at 8 AM and divided into two parts, one for detection of peripheral blood immune cell contents and the other for detection of serum enzymes polypeptide and chemokine contents after centrifugation.

#### 2.2.2. Detection method

ELISA was used to detect contents of Cat K, MMP1, MMP2, MMP9, TIMP1, Eotaxin, MCP, MDC and IL-8. FCM was used to detect contents of Th1 cell, Th2 cell, Th17 cell, CD4\(^+\)CD25\(^+\)T cell and CD8\(^+\)CD28\(^+\)T cell.

### 2.3. Statistical method

Data were analyzed by SPSS18.0 software, and measurement data was analyzed by \( t \) test. Differences were considered to be significant at a level of \( P < 0.05 \).

### 3. Results

#### 3.1. Enzymes polypeptide

It was found that serum Cat K, MMP1, MMP2 and MMP9 contents of observation group were significantly higher than those of control group and TIMP1 content was significantly lower than that of control group \( (P < 0.05) \). It indicated that serum enzymes polypeptide content of children with bronchial asthma was abnormally increased.

#### 3.2. Chemokines

It was found that serum Eotaxin, MCP-1, MCP-4, MDC and IL-8 contents of observation group were significantly higher than those of control group, which indicated that serum chemokine content of children with bronchial asthma was abnormally increased and it could mediate airway local inflammatory cell infiltration.

#### 3.3. T cell subset contents

It was found that peripheral blood Th1 cell, CD4\(^+\)CD25\(^+\)Treg cell and CD8\(^+\)CD28\(^+\)Treg cell contents of observation group were significantly lower than those of control group and Th2 cell and Th17 cell contents were significantly higher than those of control group, which indicated that there were T cell subset content disorder in children with bronchial asthma, Th1 and Treg cell contents were decreased and Th2 and Th17 cell contents were increased.

### 4. Discussions

Bronchial asthma is common in children with respiratory diseases and accurate assessment of the condition is the foundation of treatment. Airway function detection can accurately reflect respiratory function, but it needs children’s correct coordination to get accurate detection results. Compared with conventional airway function detection, hematological index detection has the advantages such as convenient sampling, strong objectivity and good repeatability; it’s not influenced by children’s coordination degree and can more accurately reflect asthma condition and provide basis for clinical treatment. In recent years, exploring hematological indexes that can accurately reflect bronchial asthma condition has

### Table 1.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Cat K (ng/L)</th>
<th>MMP1 (μg/L)</th>
<th>MMP2 (μg/L)</th>
<th>MMP9 (μg/L)</th>
<th>TIMP1 (μg/L)</th>
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</thead>
<tbody>
<tr>
<td>Observation group</td>
<td>22.95±3.61</td>
<td>11.81±1.62</td>
<td>202.57±28.42</td>
<td>422.49±65.24</td>
<td>26.71±4.45</td>
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<td>Control group</td>
<td>7.12±1.05</td>
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<td>82.48±9.47</td>
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<tr>
<td>( t )</td>
<td>20.394</td>
<td>25.982</td>
<td>15.298</td>
<td>17.029</td>
<td>18.469</td>
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<tr>
<td>( P )</td>
<td>&lt;0.05</td>
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### Table 2.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Eotaxin</th>
<th>MCP-1</th>
<th>MCP-4 (μg/L)</th>
<th>MDC (μg/L)</th>
<th>IL-8</th>
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<tr>
<td>Observation group</td>
<td>167.53±20.95</td>
<td>3.95±0.52</td>
<td>104.52±12.56</td>
<td>956.23±110.34</td>
<td>48.29±6.24</td>
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<tr>
<td>Control group</td>
<td>46.92±6.65</td>
<td>1.03±0.14</td>
<td>36.71±4.95</td>
<td>452.12±64.52</td>
<td>13.41±1.85</td>
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<tr>
<td>( t )</td>
<td>23.292</td>
<td>25.592</td>
<td>18.958</td>
<td>11.934</td>
<td>27.789</td>
</tr>
<tr>
<td>( P )</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
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</table>
always been the hot spot of clinical study. Based on knowledge of various clinical and basic studies on bronchial asthma mechanism, airway remodeling and local inflammatory cytokines are the most important pathological changes that cause bronchial asthma occurrence; a variety of enzymes polypeptide molecules are involved in the pathological process[1]. Cathepsin and MMPs families, the important members of enzymes polypeptides, include Cat K, MMP1, MMP2 and MMP9, etc, all of which are directly involved in degradation of ECM and can directly cause remodeling of airway smooth muscle. Besides, protease molecule’s degradation on ECM is conducive for a variety of inflammatory cell to locally perform the process of adhesion, migration and infiltration, which can accelerate pathological process of airway inflammatory reaction[2,3]. Tissue inhibitor of metalloproteinase (TIMP), is the molecule of inhibiting protease molecule specificity; it can inhibit Cat K and MMPs’ degradation on ECM, and thus block the pathological process of airway remodeling and inflammatory cell infiltration[4].

The research analyzed both groups’ serum enzymes polypeptide contents and it was found out that serum Cat K, MMP1, MMP2 and MMP9 contents of observation group were higher than those of control group and TIMP1 content was lower than that of control group, which indicated that serum enzymes polypeptide content of children with bronchial asthma abnormally increased and it could directly mediate pathological process of airway remodeling and inflammatory cell infiltration.

Airway local inflammatory cell infiltration is the important pathological feature of bronchial asthma. In local bronchial asthma airway, a variety of inflammatory cells such as neutrophils, monocytes and macrophages and eosinophils, etc can be detected. Chemokines that are excessively expressed in local airway are the key cell cytokines to the recruitment of inflammatory cells. According to different arrangements of N-terminal cysteines, it can be divided into four types, C type, CC type, CXC type and CX3C type, among which CC type and CXC type of chemokines are closely related to bronchial asthma occurrence. Eotaxin, monocyte chemoattractant protein, ie. MCP and macrophage derived chemokine, ie. MDC belong to CC type of chemokines; IL-8 belongs to CXC type of chemokines[5]. Eotaxin is the key cell cytokine to induce eosinophil chemotaxis, adhesion and recruitment to local airway; it can also participate in eosinophil activation and degranulation processes[6]. In monocyte chemoattractant protein family, MCP-1 and MCP-4 are closely related to asthma. They are mainly from mononuclear cells and airway epithelial cells[7]. MDC are mainly from macrophages and MoDC[8], etc. MCP-1, MCP-4 and MDC can not only directly mediate accumulation of monocytes and macrophages in local airway, but also assist Eotaxin to perform eosinophil activation process[9]. In IL family, IL-8 is currently the most potent neutrophil chemoattractant cytokine; production of IL-8 in airway can generate local infiltration of neutrophil chemotaxis[10]. The research analyzed both groups’ serum chemokine contents and it was found out that serum Eotaxin, MCP-1, MCP-4, MDC and IL-8 contents of observation group were higher than those of control group, which indicated that serum chemokine content of children with bronchial asthma abnormally increased and it could mediate airway local inflammatory cell infiltration.

Except airway remodeling and inflammatory reaction, studies in recent years have found that cell immune function disorder is also closely related to bronchial asthma occurrence. Cell immune process is mediated by a variety of T lymphocytes, including helper T cell, ie. Th and regulatory T cell, ie. Treg. Th1 and Th2 are first recovered helper T cells. Their content and function balance is important to maintain airway function[11]. Th2 cell can synthesize and secrete IL-4 and IL-5, etc and promote mass cell proliferation, induce eosinophil infiltration and thus accelerate airway inflammatory reaction development[12]. Cytokine secreted by Th1 can antagonize Th2 cell function and alleviate the pathological process of bronchial asthma[13]. Recent studies have found that except Th1 and Th2, Th17 and Treg cells are also capable of mutual adjustments. Activated Th17 cell can specifically synthesize and secrete IL-17, which has a clear pro-inflammatory effect[14]; Treg is T cell subset that negatively regulates Th17. According to different surface markers, it can be divided into two types, CD4+CD25+ Treg and CD8+CD28+ Treg, the former inhibiting Th17 cell activation by direct cell-cell function and the latter by inducing inhibitory receptor expression on antigen cell surface[15]. The research analyzed both groups’ peripheral blood T cell subset contents and it was found out that peripheral blood Th1 cell, CD4+CD25+ Treg cell and CD8+CD28+ Treg cell contents of observation group were lower than those of control group and Th2 cell and Th17 cell contents were higher than those of control group, which indicated that there were immune function disorder in children with bronchial asthma with expression of Th2 and Th17 cell function enhancement.

In conclusion, serum enzymes polypeptide and chemokine levels of children with bronchial asthma abnormally increase; contents of

<table>
<thead>
<tr>
<th>Groups</th>
<th>Th1 cell (%)</th>
<th>Th2 cell (%)</th>
<th>Th17 cell (%)</th>
<th>CD4’CD25’ cell (%)</th>
<th>CD8’CD28’ cell (%)</th>
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</thead>
<tbody>
<tr>
<td>Observation group</td>
<td>10.37±1.79</td>
<td>3.87±0.52</td>
<td>8.13±0.95</td>
<td>3.22±0.43</td>
<td>12.89±1.82</td>
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<tr>
<td>Control group</td>
<td>18.27±2.25</td>
<td>1.92±0.23</td>
<td>4.85±0.60</td>
<td>6.14±0.89</td>
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<tr>
<td>p</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
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peripheral blood T cell subsets are in disorder; it’s correlated with airway remodeling and inflammatory cell infiltration process.

References


