Expression and significance of TNF-α, IL-6, and IL-10 in the serum in patients with mycoplasma pneumonia

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ABSTRACT

Objective: To explore the expression and clinical significance of TNF-α, IL-6, and IL-10 in the serum in patients with mycoplasma pneumonia (MPP). Methods: A total of 120 patients with MPP who were admitted in our hospital from August, 2014 to June, 2015 were included in the study and served as the observation group, while 60 healthy children who came for physical examinations were served as the control group. The serum levels of IL-6, IL-10, and TNF-α in the observation group at the acute phase and recovery phase were detected and compared with the control group. The serum levels of IL-6, IL-10, and TNF-α in mild and severe MPP patients were compared. The levels of IL-6, IL-10, and TNF-α in the serum and pleural fluid in MPP patients with or with no fibrosis change were compared and analyzed. Results: When compared with the control group, the serum TNF-α and IL-6 levels in the observation group at the acute phase and recovery phase were significantly elevated, while IL-10 level was significantly reduced. The serum TNF-α and IL-6 levels in MPP patients at the acute phase were significantly lower than those at the recovery phase, while IL-10 level was significantly higher than that at the recovery phase. The serum TNF-α and IL-6 levels in the severe group were significantly higher than those in the mild group, while IL-10 level was significantly lower than that in the mild group. TNF-α level in the pleural fluid in MPP patients with fibrosis change was significantly higher than that in MPP patients with no fibrosis change, while the comparison of IL-6 and IL-10 was not statistically significant. TNF-α level in MPP patients with fibrosis change in the pleural fluid was significantly higher than that in the serum, while the comparison of IL-6 and IL-10 was not statistically significant. IL-6, IL-10, and TNF-α levels in MPP patients with no fibrosis change in the pleural fluid were not statistically different from those in the serum. Conclusions: TNF-α, IL-6, and IL-10 are involved in the pathogenesis of MPP and are associated with the severity degree and treatment outcome, which can provide an important reference evidence for the clinical diagnosis, estimation, and treatment of MPP.

1. Introduction

Mycoplasma pneumonia (MPP) is an acute respiratory and infectious disease and is a common respiratory disease in children, with an increasing morbidity in recent years[1]. Mycoplasma pneumoniae (MP) can cause a severe pulmonary infection, resulting in multi-organ and multi-system damage, and even death in a severe condition[2]. Many researches demonstrate that the pathogenesis of MPP is associated with the immunological factors. Currently, TNF-α, IL-6, and IL-10 are mainly involved in the study on MPP pathogenesis related cytokines which are abnormally expressed in an acute phase, resulting in cell immune dysfunction and hypofunction, which can not only cause pulmonary inflammation, but can also cause multi-system extrapulmonary complications[3,4]. The study is aimed to explore the expression and clinical significance of TNF-α, IL-6, and IL-10 in the serum in patients with MPP.
2. Materials and methods

2.1. General materials

A total of 120 patients with MPP who were admitted in our hospital from August, 2014 to June, 2015 were included in the study and served as the observation group, among which 67 were male, and 53 were female; aged from 1 to 10 years old, with an average age of (5.2±3.5) years old; 60 at the acute phase, and 60 at the recovery phase; 32 had mild MPP, and 28 had severe MPP according to the severity degree; X-ray chest radiograph showing that 37 had pleural fluid, among which 11 had fibrosis change, and 26 had no fibrosis change. The patients were in accordance with the diagnostic criteria of MPP[5], and were confirmed by related examinations. Those who were merged with other infectious diseases, had previous bronchial asthma and immune system diseases, and had taken glucocorticoids and immunosuppressants recently were excluded from the study. Meanwhile, 60 healthy children who came for physical examinations were served as the control group, among which 32 were male, and 28 were female; aged from 1 to 10 years old, with an average age of (5.3±3.1) years old. The comparison of the gender and age between the two groups was not statistically significant (P>0.05).

2.2. Methods

A volume of 4mL fasting venous blood in the two groups were extracted and centrifuged for serum. ELISA was used to detect the serum levels of IL-6, IL-10, and TNF-α. The serum levels of IL-6, IL-10, and TNF-α in the observation group at the acute phase and recovery phase were detected and compared with the control group. The serum levels of IL-6, IL-10, and TNF-α in mild and severe MPP patients were compared. Thoracocentesis was performed for children with pleural effusion to collect the pleural fluids. ELISA was used to observe and compare the levels of IL-6, IL-10, and TNF-α in the serum and pleural fluid in MPP patients with or with no fibrosis change.

2.3. Statistical analysis

SPSS 19.0 software was used for the statistical analysis. Chi-square test was used for the enumeration data. The measurement data were expressed as mean ± SD, and t test was used. P<0.05 was regarded as statistically significant.

3. Results

3.1. Comparison of the serum levels of IL-6, IL-10, and TNF-α between the two groups

When compared with the control group, the serum TNF-α and IL-6 levels in the observation group at the acute phase and recovery phase were significantly elevated, while IL-10 level was significantly reduced (P<0.05). The serum TNF-α and IL-6 levels in MPP patients at the acute phase were significantly higher than those at the recovery phase, while IL-10 level was significantly lower than that at the recovery phase (P<0.05) (Table 1).

3.2. Comparison of the serum levels of IL-6, IL-10, and TNF-α between the mild and severe MPP patients

The serum TNF-α and IL-6 levels in the severe group were significantly lower than those in the mild group, while IL-10 level was significantly lower higher than that in the mild group (P<0.05) (Table 2).

3.3. Comparison of the levels of IL-6, IL-10, and TNF-α in the serum and pleural fluid in MPP patients with or with no fibrosis change

TNF-α level in the pleural fluid in MPP patients with fibrosis change was significantly higher than that in MPP patients with no fibrosis change (P<0.05), while the comparison of IL-6 and IL-10 was not statistically significant (P>0.05). TNF-α level in MPP patients with fibrosis change in the pleural fluid was significantly higher than that in the serum (P<0.05), while the comparison of IL-6 and IL-10 was not statistically significant (P>0.05). IL-6, IL-10, and TNF-α levels in MPP patients with no fibrosis change in the pleural fluid were not statistically different from those in the serum (P>0.05) (Table 3).

**Table 1.**

Comparison of the serum levels of IL-6, IL-10, and TNF-α between the two groups (pg/mL).

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>IL-6</th>
<th>IL-10</th>
<th>TNF-α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute phase</td>
<td>60</td>
<td>81.75±15.26</td>
<td>11.72±5.27</td>
<td>32.75±9.45</td>
</tr>
<tr>
<td>Recovery phase</td>
<td>60</td>
<td>23.74±10.25</td>
<td>14.74±8.56</td>
<td>14.15±3.42</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td>11.18±3.57</td>
<td>23.47±6.31</td>
<td>7.22±3.05</td>
</tr>
</tbody>
</table>

1P<0.05, when compared with the control group; 2P<0.05, when compared with the recovery phase.

**Table 2.**

Comparison of the serum levels of IL-6, IL-10, and TNF-α between the mild and severe MPP patients (pg/mL).

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>IL-6</th>
<th>IL-10</th>
<th>TNF-α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>27</td>
<td>64.55±17.54</td>
<td>13.18±2.68</td>
<td>23.67±5.62</td>
</tr>
<tr>
<td>Severe</td>
<td>33</td>
<td>92.32±19.76</td>
<td>8.67±4.35</td>
<td>37.65±4.38</td>
</tr>
</tbody>
</table>

1P<0.05, when compared with the mild group.
MP is a kind of pathogenic bacteria between the bacteria and virus. MPP is a common respiratory and infectious disease in children, highly occurring in the spring and autumn, characterized by severe condition, long course, and many extra-pulmonary organs involved, and can easily induce obliterans bronchiolitis, and chronic or refractory pneumonia[6]. The pathogenesis of MPP is not yet clear, and is deemed to be associated with the immunological mechanism and the direct implantation of pathogens, among which the immunological mechanism is widely acknowledged in the medical field[7]. Some researches demonstrate that MP infection can induce various cytokines which are deemed to have important significance in the occurrence, development, and prognosis of MPP[8]. MP infection can activate the immune cells to produce various cytokines which can act on T and B cells to regulate the immune function and mediate the immune response and inflammatory reaction to eliminate the pathogens through combination with the cell surface receptors[9].

Li et al[10] have studied the correlation of serum levels of IL-6, IL-10, and TNF-α with the severity degree in children with MPP, and the results showed that the serum IL-6 and TNF-α levels at the acute phase were elevated, while IL-10 was reduced, and were significantly different from those at the recovery phase and in the healthy children, indicating that IL-6, IL-10, and TNF-α play an important role in the pathogenesis of MPP, whose level is associated with the severity degree.

TNF-α is an important mediator with biological activities, with a low level in a normal condition, and can resist the infection, regulate the immunity, promote the proliferation and differentiation of cell, and protect the body to a certain degree. TNF-α in a high level is an important inflammatory transmitter, can mediate the pathological and physiological process of inflammatory reaction to cause local inflammatory reaction, resulting in organ or multi-system damage[11,12]. It is reported by Sun et al that[13] the serum TNF-α level in MPP patients was significantly higher than that in the normal children, and the correlation coefficient and determination coefficient could the significant levels, showing that TNF-α is probably taken as an important inflammatory mediator to be involved in the immunological process. IL-6 is a cytokine with wide biological activities, is involved in the regulation of cell immunity and humoral immunity, and plays an important role in the autoimmunity and inflammatory reaction[7]. IL-6 has a dual-directional regulation, in a normal level can promote the activation of B cell, induce the synthesis of T cell and the expression of IL-2, and inhibit the secretion of TNF-α; while in a high level can significantly inhibit the expressions of T cell and IL-2[12,14]. IL-6 is an important cytokine to mediate the inflammatory reaction at an acute phase, can induce T cell differentiation and B cell growth, and secrete the immunoglobulin during MP infection, and is involved in the pathological process of inflammatory reaction[3]. IL-10 is a kind of inhibitory and lymphatic factor, with biological characteristics of regulating the proliferation and differentiation of immune cells, and restricting the inflammatory reaction[15]. Some researches demonstrate that in the inflammatory diseases, IL-10, as an effective anti-inflammatory substance, can protect the body from an excessive pathological reaction to prevent the damage of pro-inflammatory cytokines on the body, which can inhibit the immunity increase the infection risk[16].

The results in the study showed that when compared with the control group, the serum TNF-α and IL-6 levels in the observation group at the acute phase and recovery phase were significantly elevated, while IL-10 level was significantly reduced (P<0.05); the serum TNF-α and IL-6 levels in MPP patients at the acute phase were significantly lower than those at the recovery phase, while IL-10 level was significantly higher than that at the recovery phase (P<0.05); the serum TNF-α and IL-6 levels in the severe group were significantly higher than those in the mild group, while IL-10 level was significantly lower than that in the mild group (P<0.05); TNF-α level in the pleural fluid in MPP patients with fibrosis change was significantly higher than that in MPP patients with no fibrosis change (P<0.05), while the comparison of IL-6 and IL-10 was not statistically significant (P>0.05); TNF-α level in MPP patients with fibrosis change in the pleural fluid was significantly higher than that in the serum (P<0.05), while the comparison of IL-6 and IL-10 was not statistically significant (P>0.05). IL-6, IL-10, and TNF-α levels in MPP patients with no fibrosis change in the pleural fluid were not statistically different from those in the serum (P>0.05), suggesting that IL-6, IL-10, and TNF-α are involved in the pathogenesis and immunological process of MPP, resulting in pulmonary fibrosis, which is probably associated with the severity degree and outcome.

In conclusion, TNF-α, IL-6, and IL-10 are involved in the pathogenesis of MPP and are associated with the severity degree.
and treatment outcome, which can provide an important reference
evidence for the clinical diagnosis, estimation, and treatment of MPP.

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