Changes and significance of inflammatory reaction and immune function in children with infectious pneumonia

Xiong–Hai Li¹, Xiao–Qin Wang², Qi Liang³

¹ Xi’an Jiaotong University, Shaanxi, Xi’an 710061, China
² Department of Clinical Laboratory, the First Affiliated Hospital of Xi’an Jiaotong University, Shaanxi, Xi’an 710061, China
³ Clinical Laboratory, Affiliated Hospital of Chuanbei Medical College, Nanchong 637000 China

ARTICLE INFO

Article history:
Received 2 Nov 2017
Received in revised form 9 Nov 2017
Accepted 12 Nov 2017
Available online 28 Nov 2017

Keywords:
Infectious pneumonia
Inflammatory reaction
Immune function
Detection and significance

ABSTRACT

Objective: To investigate the changes of inflammatory factors and immune function indexes in children with infectious pneumonia, to analyze the relationship between the level of indicators and the severity of the disease. Methods: A total of 160 children with infectious pneumonia were selected as the observation group included bacterial pneumonia group (n=98), mycoplasma pneumonia group (n=32) and viral pneumonia group (n=30), according to the severity of the disease, they were divided into mild group (n=105) and severe group (n=55), at the same time 100 cases of healthy children in the same period were selected as control group, the levels of inflammatory factors and the indexes of immune function were compared between the groups and different courses of disease. Results: Compared with the control group, the levels of hs-CRP and PCT in the observation group were significantly increased, and in the observation group, the bacterial pneumonia group of hs-CRP and PCT levels were significantly higher than those in mycoplasma pneumonia group and viral pneumonia group, compared with the viral pneumonia group hs-CRP level, the level in the mycoplasma pneumonia group was significantly increased; The comparison of immune function index, the observation group CD3+, CD4+ and CD4+/CD8+ levels [(66.32±8.61)%, (36.51±6.26), (1.21±0.29)] were significantly lower than those of the control group, the level of CD8+ (26.34±5.11)% was significantly higher than the control group (22.75±3.88)%, but the levels of CD3+, CD4+, CD8+ and CD4+/CD8+ in each group of the observation group were not statistically significant; The severe group hs-CRP, PCT and CD8+ levels were significantly higher than the mild group, and the levels of CD3+, CD4+ and CD4+/CD8+ were significantly decreased. Conclusion: There is a marked inflammatory response and abnormal cellular immune function in children with infectious pneumonia, and its level detection is of great value in the diagnosis of disease and the assessment of the severity of the disease.

1. Introduction

Infectious pneumonia is one of the common pediatric clinical diseases, the incidence is high in infants and young children, the clinical manifestations are fever, cough, difficulty breathing, etc[1]. Its morbidity and mortality are high, and infantile pneumonia is one of the major causes of death in children under 5 years old[2,3]. Early diagnosis and treatment of children is important for mortality reduction. The current study has confirmed that the body’s inflammatory stress response play an important role in the infection and injury, pathogenesis of pneumonia is related to immune dysfunction[4-6]. In this study, children with infectious pneumonia were selected as the main research objects. The levels of inflammatory factors and immune function in children with bacterial pneumonia, mycoplasma pneumonia and viral pneumonia and in different course of diseases were compared to provide data support for the diagnosis and assessment of disease severity.
2. Data and methods

2.1 General data

A total of 160 children with infectious pneumonia treated in our hospital from February 2016 to July 2017 were selected as the observation group, all of them were accompanied by clinical signs of respiratory tract infection. According to the clinical symptoms, laboratory tests and X-ray results confirmed in line with the diagnostic criteria for pneumonia[7], accompanied by; and excluded: (1) with other infectious diseases, autoimmune diseases and congenital genetic metabolic diseases in children; (2) children with abnormal liver function; (3) recurrent respiratory tract infections, children with bronchial asthma; (4) received antibiotics before treatment in children. Research content and procedures are in line with the standards of the hospital ethics committee, conducted after the permission of ethics committee. Among the 160 children with infectious pneumonia, 98 children with bacterial pneumonia (bacterial pneumonia group), 32 children with mycoplasmal pneumonia (mycoplasma pneumonia group) and 30 children with viral pneumonia pneumonia group, in bacterial pneumonia group 57 cases of male children, 41 cases of female children, aged from 3 to 11 years; in bronchial pneumonia pneumonia group including 17 male children, 15 female children patients, aged from 3 to 10 years old; in viral pneumonia group 17 male children patients, 13 female children patients, aged from 3 years to 11 years; based on the comprehensive evaluation of pneumonia[8]. 160 cases of patients in observation group can be divided into mild pneumonia in 105 cases (mild group), severe pneumonia 55 cases (severe group). In the same period, 100 healthy children were selected as the control group (no substantial difference in sex ratio and age between the two groups). There were 60 males and 40 females aged from 3 to 11 years old. There was no significant difference in sex ratio and age between the two groups (P>0.05). All families were informed consent for the study and signed informed consent.

2.2 Index detection

All children were extracted 3 mL of fasting peripheral venous blood samples, divided into two tubes, a tube centrifuged 3 000 r/min, for 10 min, serum was taken to detect the level of inflammatory cytokines [high sensitive c-reactive protein (hs-CRP), procalcitonin (PCT)], hs-CRP testing equipment was the Hitachi 7600-220 automatic biochemical pipeline, latex enhanced immune turbidimetric method was used, the detection kit provided by the Sichuan Michael Biotechnology Co., Ltd.; testing equipment for PCT was the Roche cobas E601 automatic electrochemical luminescence immunoassay, the method was enzyme-linked immunosorbent assay, used Roche original reagents; another tube was used for detecting immune function indicators [CD3+,CD4+, CD8+], the United States Beckman Coulter Epics XL flow cytometry and Beckman original reagents for testing.

2.3 Statistical process and analysis

Data processing software was SPSS 17.0, inflammatory factors and immune function indicators after normality test were conformed to the normal distribution after normalized validation, presented by Mean ± SD, compared indicator samples among different groups by single-factor analysis of variance, comparison of indicators between the two groups by the LSD-t test, P<0.05 indicated statistically significant difference.

3 Results

3.1 Comparison of inflammatory factors levels among all groups

Through detection, the levels of hs-CRP and PCT in the observation group were (12.09±6.63) mg/L and (2.29±1.79) μg/L respectively, which were significantly higher than those in the control group (1.87±0.91) mg/L and (0.12±0.02) μg/L, the difference was statistically significant (P<0.05). The results of single-factor analysis of variance showed that the difference in hs-CRP and PCT between control group and observation group was statistically significant (P<0.05). Compared with the control group, the levels of hs-CRP and PCT in bacterial pneumonia group, mycoplasma pneumonia group and viral pneumonia group were significantly increased (P<0.05), and hs-CRP and PCT levels in mycoplasma pneumonia group and viral pneumonia group were significantly lower than those in bacterial pneumonia group, the difference was significant (P<0.05). The levels of hs-CRP and PCT in viral pneumonia group were (4.37±1.29) mg/L and (0.21±0.07) μg/L, which was lower than mycoplasma pneumonia group at different extent [(6.62±1.81) mg/L, (0.24±0.08) μg/L], and the level of hs-CRP decreased more obviously, the difference was significant (P<0.05) (Table 1).

Table 1.
Comparison of inflammatory factors levels among all groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>hs-CRP (mg/L)</th>
<th>PCT (μg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>100</td>
<td>1.87±0.91</td>
<td>0.12±0.02</td>
</tr>
<tr>
<td>Observation group</td>
<td>160</td>
<td>12.09±6.63</td>
<td>2.29±1.79</td>
</tr>
<tr>
<td>Bacterial pneumonia group</td>
<td>98</td>
<td>15.95±5.89</td>
<td>3.35±1.01</td>
</tr>
<tr>
<td>Mycoplasma pneumonia group</td>
<td>32</td>
<td>6.62±1.81</td>
<td>0.24±0.08</td>
</tr>
<tr>
<td>Viral pneumonia group</td>
<td>30</td>
<td>4.37±1.29</td>
<td>0.21±0.07</td>
</tr>
</tbody>
</table>

Note: Compared with the control group, *P<0.05; compared with bacterial pneumonia group †P<0.05; compared with mycoplasma pneumonia group, ‡P<0.05.
3.2 Comparison of immune function among groups

The results of single-factor analysis of variance showed that there were significant differences in T lymphocyte levels (CD3⁺, CD4⁺, CD8⁺ and CD4⁺/CD8⁺) between the control group and the observation group (P<0.05), compared with the control group, the levels of CD3⁺, CD4⁺ and CD4⁺/CD8⁺ in the other three groups were significantly decreased, the difference was significant (P<0.05). Compared with the mycoplasma pneumonia group and the viral pneumonia group, these three levels in bacterial pneumonia group decreased, however the difference was not significant (P>0.05). The level of CD8⁺ in the three groups of observation group was significantly higher than that in the control group (P<0.05), and the level of CD8⁺ in bacterial pneumonia group was (26.70±5.63)% slightly higher than that in mycoplasma pneumonia group (26.22±4.47)% and viral pneumonia group (25.47±4.09)%, the difference was not statistically significant (P>0.05) (Table 2).

3.3 Comparison of inflammatory factors levels in different stages of disease

hs-CRP, PCT detection results in different stages of disease were shown in Table 3. Compared with the mild group, the levels of hs-CRP and PCT in the severe group were (19.83±3.61) mg/L and (2.71±0.60) µg/L respectively, both were significantly increased and the difference was statistically significant (P<0.05).

4. Discussion

The incidence of infectious pneumonia mainly related to incomplete respiratory system development and autoimmune dysfunction in infants[9,10]. Due to more pathogenic microorganisms, the difference in treatment drugs is also larger, pathogens of pneumonia in children include bacteria, mycoplasma and viruses three categories, previous studies have pointed out that in patients with infectious pneumonia, bacterial pneumonia was mainly part (count for 80%), Epidemiological studies in recent years showed that the incidence of mycoplasma pneumonia was gradually increased[11-13]. The diagnosis of infectious pneumonia mainly bases on clinical signs, leukocyte levels and etiological examination, and such indicators are often affected by technical conditions, antibiotics and other factors, there are still some patients misdiagnosed atypical symptoms, and thus affect the diagnosis[14]. Therefore looking for a simple, rapid and sensitive detection method is the hot point of current research, and is of great significance to the diagnosis, treatment and prognosis of diseases.

Both hs-CRP and PCT belong to the important inflammatory cytokines of the body. Under normal physiological conditions, hs-CRP and PCT are both low in the serum. In the event of microbial invasion and tissue damage, body would massively synthesize and release hs-CRP and PCT, resulting in a sharp increase in serum hs-CRP and PCT levels, the level is related to the extent of infection and damage[15,16]. The study pointed out that in the process of infection, endotoxin had greater impact on PCT level[17]. The results of this study showed that hs-CRP and PCT levels in children with infectious pneumonia were significantly higher than healthy children, and hs-CRP and PCT levels in children with bacterial pneumonia in the group of infectious pneumonia group were significantly higher than the remaining two groups of children, the level of hs-CRP in mycoplasma pneumonia group and viral pneumonia was statistically significant (P<0.05).
significant, while there was no significant difference in PCT level. As the severity of the disease aggravated, the levels of hs-CRP and PCT in children were significantly increased. The results revealed that there was a significant inflammatory response in children with infectious pneumonia. Inflammatory factors level correlated with the severity of the disease. The detection of hs-CRP and PCT levels is of great importance in distinguishing the bacterial infections.

The pathogenesis of infectious pneumonia is still not yet clear, the study pointed out that may be related to abnormal immune function, T lymphocyte-mediated cellular immune function plays an important regulatory role[18,19]. The ratio of CD4+/CD8+ is an important indicator reflecting immune function of the body. The decrease of this value reveals that the immune function is inhibited to a certain degree[20]. Research showed that when the body’s immune system was activated after microbial invasion, leading to abnormal levels of immune-related indicators, resulted in inhibition of immune function, reducing the body’s resistance to disease[21,22]. The results showed that compared with the control group, the levels of CD3+, CD4+ and CD4+/CD8+ in the observation group were significantly decreased and the level of CD8+ was significantly increased. This revealed that immune function of the children with infectious pneumonia was inhibited, and with the severity of the disease deepened, the immunosuppression was more significant, indicating that cellular immune function involved in the pathogenesis and development of infectious pneumonia. In addition, the study also found that in different types of infectious pneumonia, immune function was no significant difference, the results showed that immune function can be used for the diagnosis of infectious pneumonia and the assessment of disease severity, but cannot be used to distinguish the types of pathogenesis.

In summary, the detection of hs-CRP and PCT levels and immune function in children patients played critical role in infectious pneumonia diagnosis and evaluation for course of disease, hs-CRP and PCT levels also contributed to the differential diagnosis of infectious pneumonia pathogens.

References