Correlation of serum P2X7 receptor, CD64 and CD54 expression with infection process in children with bacterial pneumonia

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ABSTRACT

Objective: To investigate the correlation of serum P2X7 receptor, CD64 and CD54 expression with infection process in children with bacterial pneumonia. Methods: A total of 164 children with bacterial pneumonia hospitalized in this hospital between June 2016 and February 2018 were selected as bacterial pneumonia group, and 100 healthy children who received vaccination in this hospital during the same period were selected as normal control group. The expression levels of P2X7 receptor, CD64 and CD54 as well as the contents of inflammatory factors, acute phase proteins and immunoglobulins in serum of the two groups were detected. Results: Immediately after admission, serum P2X7 receptor, CD64 and CD54 expression of bacterial pneumonia group were higher than those of normal control group, inflammatory cytokines TNF-α, sTREM-1, IL-2 and IL-6 contents were higher than those of normal control group, acute phase proteins 1-AGP, CRP, CP and HP contents were higher than those of normal control group, and immunoglobulins IgA, IgM and IgG contents were higher than those of normal control group; serum P2X7 receptor, CD64 and CD54 expression in children with bacterial pneumonia were positively correlated with TNF-α, sTREM-1, IL-2, IL-6, 1-AGP, CRP, CP, HP, IgA, IgM and IgG contents. Conclusion: The serum P2X7 receptor, CD64 and CD54 expression increase in children with bacterial pneumonia, and they are positively correlated with the degree of infection.

In this study, P2X7 receptor, CD64 and CD54 expression in children with bacterial pneumonia were discussed, and the inner link between their expression and the specific illness was further explored so as to find sensitive markers for the early diagnosis and evaluation of bacterial pneumonia in the future, which is reported as follows.

1. Introduction

Bacterial pneumonia is the most common respiratory system disease in children and poses a great threat to children's health, and severe cases can even progress to severe pneumonia and threaten life safety[1,2]. Early diagnosis of disease and confirmation of disease status is the key to the treatment of bacterial pneumonia, but the early clinical manifestations of various types of pneumonia are similar, and how to identify them is a difficult point in clinical research. P2X7 receptor has been confirmed to participate in the regulation of chronic inflammatory respiratory system disease, CD64 and CD54 expression are closely related to the degree of inflammatory response, and the detection of the above factor expression is expected to become the reliable means for early diagnosis of bacterial pneumonia and judgment of its course[3].
2.2 Case information

A total of 164 children with bacterial pneumonia were hospitalized in the hospital between June 2016 and February 2018 and included in the bacterial pneumonia group, and 100 healthy children who received vaccination in the hospital during the same period were included as normal control group. Bacterial pneumonia group included 80 males and 84 females who were 2-11 years old; control group included 52 males and 48 females who were 1-12 years old. There was no significant difference in the distribution of above baseline data between groups, and the subsequent data were comparable. The research plan was approved by the hospital ethics committee.

2.3 P2X7 receptor, CD64 and CD54 expression detection

Immediately after admission (before treatment), the peripheral blood samples were obtained from the two groups of children to separate serum, and the expression of P2X7 receptor, CD64 and CD54 were detected by chemiluminescent immunoassay kit.

2.4 Infection-related index content detection

Immediately after admission (before treatment), the serum samples were also obtained from the two groups of children, and the upper serum was isolated and then cryopreserved for test. Elisa kit was adopted to detect serum levels of inflammatory factors and acute phase proteins, inflammation factors included tumor necrosis factor -α (TNF-α), soluble triggering receptor expressed on myeloid cells-1 (sTREM-1), interleukin-2 (IL-2) and interleukin 6 (IL-6), and acute phase proteins included α 1 acid glycoprotein (α 1-AGP), C-reactive protein (CRP), ceruloplasmin (CP) and haptoglobin (HP). Immunoturbidimetry was adopted to determine the serum levels of immunoglobulins, including immunoglobulin A (IgA), immunoglobulin (IgM) and immunoglobulin (IgG).

2.5 Statistical methods

P2X7 receptor, CD64 and CD54 expression as well as inflammatory factor, acute phase protein and immunoglobulin contents were all expressed as mean ± standard deviation, and the comparison between groups was by grouping t test. Software SPSS23.0 was used for calculating statistics P, and P<0.05 indicated statistical significance in differences.

3. Results

3.1 P2X7 receptor, CD64 and CD54 expression

Comparison of serum P2X7 receptor, CD64 and CD54 expression between the two groups of children was as follows: immediately after admission, serum P2X7 receptor, CD64 and CD54 expression of bacterial pneumonia group were significantly higher than those of normal control group. Differences in serum P2X7 receptor, CD64 and CD54 expression were statistically significant between the two groups of children (P<0.05). The details were shown in Table 1.

3.2 Inflammatory factors

Comparison of serum inflammatory factors TNF-α, sTREM-1, IL-2 and IL-6 contents between the two groups of children was as follows: immediately after admission, serum TNF-α, sTREM-1, IL-2 and IL-6 contents of bacterial pneumonia group were significantly higher than those of normal control group. Differences in serum TNF-α, sTREM-1, IL-2 and IL-6 contents were statistically significant between the two groups of children (P<0.05). The details were shown in Table 2.

3.3 Acute phase proteins

Comparison of serum acute phase proteins 1-AGP, CRP, CP and HP contents between the two groups of children was as follows: immediately after admission, serum 1-AGP, CRP, CP and HP contents of bacterial pneumonia group were significantly higher than those of normal control group. Differences in serum 1-AGP, CRP, CP and HP contents were statistically significant between the two groups of children (P<0.05). The details were shown in Table 3.

3.4 Immunoglobulins

Comparison of serum immunoglobulins IgA, IgM and IgG contents between the two groups of children was as follows: immediately after admission, serum immunoglobulins IgA, IgM and IgG contents of bacterial pneumonia group were significantly higher than those of normal control group. Differences in serum IgA, IgM and IgG contents were statistically significant between the two groups of children (P<0.05). The details were shown in Table 4.
occurrence of pneumonia in healthy population, and it has been confirmed to participate in the such as inflammation, infection and tumor, but it is less expressed
continuously synthesized and enter into the blood circulation, which is the constant stimulation of pathogens, the inflammatory factors are damage the lung tissue and cause local inflammation. Under the
infected the children's lungs, pathogens rapidly proliferate, damage the lung tissue and cause local inflammation. Under the constant stimulation of pathogens, the inflammatory factors are continuously synthesized and enter into the blood circulation, which form inflammatory cascade reaction and further damage important organs such as heart, liver and kidney. The condition of bacterial pneumonia is highly consistent with the degree of systemic inflammatory response in children, so the inflammatory mediator contents can objectively reflect the illness. TNF-α, IL-2 and IL-6 are all typical pro-inflammatory factors, which can further induce the synthesis and release of other inflammatory factors and participate in the progression of bacterial pneumonia. The P2X7 receptor, CD64 and CD54 are all typical pro-inflammatory factors, which can further induce the synthesis and release of other inflammatory factors and participate in the progression of bacterial pneumonia. The P2X7 receptor, CD64 and CD54 are massively expressed in many diseases such as inflammation, infection and tumor, but it is less expressed in healthy population, and it has been confirmed to participate in the occurrence of systemic inflammatory response. The P2X7 receptor, CD64 and CD54 expression is the same as that of different bacterial pneumonia. Correlation analysis showed that P2X7 receptor, CD64 and CD54 expression in children with bacterial pneumonia were positively correlated with the above inflammatory factor contents, which explains that P2X7 receptor, CD64 and CD54 expression can early judge the systemic inflammation degree in children.

Acute phase protein is a type of proteins massively synthesized by the body under infection, inflammation, trauma and other circumstances, and their specific synthesis is well correlated with the occurrence intensity of stress events. CRP is synthesized by the liver and can be used for bacterial and viral infection, and its content is not affected by other drugs, and its content changes are more sensitive than those of white blood cells; CP can regulate the distribution of copper in various parts of the body, and its expression level increases in patients with severe infection and malignant tumor; HP is an α2 globulin that is synthesized by the liver and is also an acute phase protein, and its expression may increase during the occurrence of stress events. The results of this study showed that compared with those of normal control group, serum α1-AGP, CRP, CP and HP contents were higher in the children with bacterial pneumonia. Correlation analysis showed that P2X7 receptor, CD64 and CD54 expression in children with bacterial pneumonia were positively correlated with the above inflammatory factor contents, which explains that P2X7 receptor, CD64 and CD54 expression can early judge the systemic inflammation degree in children.

3.5 Correlation analysis

Pearson test showed that serum P2X7 receptor, CD64 and CD54 expression of bacterial pneumonia group were positively correlated with inflammatory factors TNF-α, sTREM-1, IL-2 and IL-6 contents; they were positively correlated with acute phase proteins 1-AGP, CRP, CP and HP contents; they were positively correlated with immunoglobulins IgA, IgM and IgG contents (P<0.05).

4. Discussion

Bacterial pneumonia is a serious respiratory system disease in childhood, the children may be with febrile convulsion, cough and expectoration, nausea and vomiting, fatigue and so on, and it can endanger the children’s life if not controlled in time. The early clinical symptoms of bacterial pneumonia are not significant, and they may affect the illness adversely and influence the final treatment outcome. Looking for the sensitive indexes for early diagnosis of bacterial pneumonia is the key to disease treatment, it has been reported in different literatures that P2X7 receptor, CD64 and CD54 may participate in the occurrence and development of bacterial pneumonia, but there is still not much relevant clinical research. P2X7 receptor has many biological functions, including inducing cells to produce inflammatory cytokines, activating T cells, inducing lymphocytes to form vesicles, etc; CD64 is rarely expressed on the surface of normal cells, and it is stimulated by a variety of inducing lymphocytes to form vesicles, etc; CD64 is rarely expressed on the surface of normal cells, and it is stimulated by a variety of drugs, and its content changes are more sensitive than those of white blood cells; and CD54 may participate in the occurrence and development of severe infection and malignant tumor.

Correlation analysis showed that P2X7 receptor, CD64 and CD54 expression in children with bacterial pneumonia were higher. Correlation analysis showed that P2X7 receptor, CD64 and CD54 expression in children with bacterial pneumonia were positively correlated with the above inflammatory factor contents, which explains that P2X7 receptor, CD64 and CD54 expression can early judge the systemic inflammation degree in children.

Table 3.
Comparison of serum acute phase protein contents between the two groups (mg/L).

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>1-AGP</th>
<th>CRP</th>
<th>CP</th>
<th>HP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal control group</td>
<td>100</td>
<td>73.82±9.15</td>
<td>2.07±0.25</td>
<td>104.37±12.58</td>
<td>50.73±5.81</td>
</tr>
<tr>
<td>Bacterial pneumonia group</td>
<td>164</td>
<td>163.29±20.11</td>
<td>15.67±2.43</td>
<td>438.24±53.91</td>
<td>139.62±15.18</td>
</tr>
<tr>
<td>t</td>
<td>20.193</td>
<td>11.274</td>
<td>19.304</td>
<td>15.724</td>
<td></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></td>
</tr>
</tbody>
</table>

Table 4.
Comparison of serum immunoglobulin contents between the two groups (g/L).

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>IgA</th>
<th>IgM</th>
<th>IgG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal control group</td>
<td>100</td>
<td>1.03±0.16</td>
<td>0.98±0.15</td>
<td>5.83±0.64</td>
</tr>
<tr>
<td>Bacterial pneumonia group</td>
<td>164</td>
<td>1.58±0.19</td>
<td>2.11±0.24</td>
<td>9.71±1.08</td>
</tr>
<tr>
<td>t</td>
<td>7.392</td>
<td>10.628</td>
<td>8.452</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td></td>
</tr>
</tbody>
</table>
occurrence of infectious diseases in the body[18,19]; IgM first appears
in the immune response, it has the functions such as bacteriolyis and
hemolysis, and its expression level also increases in the early stage
of infection[20,21]; IgA has multiple functions such as antibacterial,
disease-resistant and antitoxin, the body reactively increases IgA
expression after the invasion of pathogenic bacteria so as to suppress
the increase of systemic infection, and this is a self-protection
mechanism of the body[22]. The results of the study showed that
the serum IgA, IgM and IgG contents of bacterial pneumonia
group were higher than those of control group. Correlation analysis
showed that P2X7 receptor, CD64 and CD54 expression in children
with bacterial pneumonia were positively correlated with above
immunoglobulin contents, and it indicates that P2X7 receptor, CD64
and CD54 expression can objectively reflect the immunoglobulin
contents, and indirectly reflect the illness of children with severe
pneumonia.

To sum up, serum P2X7 receptor, CD64 and CD54 expression
abnormally increase in children with bacterial pneumonia, the
specific expression levels are positively correlated with the body’s
inflammatory factor, acute phase protein and immunoglobulin
content. They can be used as reliable indexes to early diagnose
the disease and judge its condition, and they are worthy to be
popularized and applied in clinical practice in the future.

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