Effect of dobutamine combined with meropenem on serum BNP, IGF-1, IGFBP-3, TNF-a, IL-6 and hs-CRP in children with congenital heart disease and pneumonia

Yan-Li Xie*, Tao Wang

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Abstract

Objective: To study the effect of dobutamine combined with meropenem on serum BNP, IGF-1, IGFBP-3, TNF-a, IL-6 and hs-CRP in children with congenital heart disease and pneumonia. Methods: A total of 70 children with congenital heart disease and pneumonia in our hospital from June 2014 to October 2016 were enrolled in this study. The subjects were divided into the control group (n=35) and the treatment group (n=35) randomly. The control group was treated with dobutamine, the treatment group were treated with dobutamine combined with meropenem. The two groups were treated for 10 days. The serum BNP, IGF-1, IGFBP-3, TNF-a, IL-6 and hs-CRP levels of the two groups before and after treatment were compared. Results: There were no significantly differences of the serum BNP, IGF-1, IGFBP-3, TNF-a, IL-6 and hs-CRP levels of the two groups before treatment. The serum BNP, TNF-a, IL-6 and hs-CRP levels of the two groups after treatment were significantly lower than before treatment, the serum IGF-1 and IGFBP-3 levels of the two groups after treatment were significantly higher than before treatment, and that of the treatment group were significantly better than the control group. Conclusion: Dobutamine combined with meropenem can significantly reduce the serum BNP, TNF-a, IL-6 and hs-CRP levels, improve serum IGF-1 and IGFBP-3 levels of children with congenital heart disease and pneumonia, and it was worthy clinical application.

1. Introduction

Congenital heart disease (CHD), also known as congenital heart disease, is a common cardiovascular surgical disease in pediatrics. It occurs in the fetal period and is caused by malformation of fetal cardiac vascular development[1]. Left to right congenital heart disease, due to poor immunity, children with pneumonia, and thus leading to heart failure, and it has the characteristics of acute onset and severe symptoms[2]. In recent years, due to the change of people’s living habits and the deterioration of living environment, the incidence of congenital heart disease in children with pneumonia complicated with heart failure rate has increased year by year, which seriously affect children’s life safety, also became a great burden for families of children[3]. Because of the poor tolerance to surgical treatment for children with congenital heart disease combined with heart failure pneumonia, it is important to control pulmonary inflammation before operation and to improve heart failure[4-5]. Dobutamine, a dopamine derivative, acts mainly on beta 1 receptors and exerts positive inotropic effects on the heart[6]. Meropenem is a new type of carbapenem antibiotics, it has strong antibacterial activity against gram positive, negative aerobic bacteria and all anaerobic bacteria[7]. This study was to explore the effect of dobutamine combined with meropenem on serum BNP, IGF-1, IGFBP-3, TNF-a, IL-6 and hs-CRP in children with congenital heart disease and pneumonia. The results are as follows.
2. Informations and Methods

2.1. General information

A total of 70 children with congenital heart disease and pneumonia in our hospital from June 2014 to October 2016 were enrolled in this study. Case inclusion criteria: (1) The diagnosis of the congenital heart disease were confirmed by the imaging examination; (2) Pneumonia was confirmed by imaging or laboratory examination; (3) The clinical symptoms and imaging findings were heart failure; Case exclusion criteria: (1) Children with multiple organ failure; (2) Children with hepatic or renal dysfunction; (3) Children who were not tested for drug intolerance.

The 70 children included in this study were randomly divided into two groups: control group and treatment group, 35 cases in each group. There were 18 males and 17 females in the control group, they were aged from 6 to 24 months; Cardiac function classification: 9 cases of grade I, 18 cases of grade II, 8 cases of grade III. There were 19 males and 16 females in the treatment group, they were aged from 6 to 23 months; Cardiac function classification: 7 cases of grade I, 19 cases of grade II, 9 cases of grade III. The general clinical data of the two groups were compared, including sex, age, cardiac function classification, etc. And there was no significant difference between the two groups (P>0.05). All the children in the study were informed of the study contents of the patients themselves and their relatives before the treatment, and informed consent was signed with the consent of the family members. In addition, the subject was approved by the medical ethics committee of our hospital.

2.2 Treatment methods

All the children were given a series of routine treatment after admission, including heart dilatation, dilatation, diuresis, oxygen inhalation, sedation, sputum aspiration, water electrolyte balance, etc.: The control group were treated with dobutamine (Purchased from Wuxi cave Pharmaceutical Co., Ltd., specifications 0.25 g/branch, Chinese medicine standard word: H32021834), Specifically, the glucose solution was administered at a dose of 5 g/(kg•min) and continued intravenously for 7-10 d. The treatment group were given meropenem therapy (Purchased from Shenzhen Haibin Pharmaceutical Co., Ltd., specifications 0.25 g/branch, Chinese medicine standard word: H20010249) based on the treatment in control group, Specific for: 0 mg/kg/dose, Q8h, continuous treatment for 7-10 d.

2.3 Detection index

Collected fasting venous blood 5 mL of two groups of patients before and after treatment, then serum separation for 10 min with a speed of 3 000 rpm. Detect and compare serum levels of BNP, IGF-1, IGFBP-3, TNF-α, IL-6 and hs-CRP before and after treatment.

Serum levels of IGF-1 and IGFBP-3 were detected by chemiluminescence method, and the kit was purchased from Shanghai surplus Biotechnology Co., ltd.; Serum BNP was detected by immunofluorescence dry quantitative method, and the instrument was purchased from Triage Metpro immunoassay analyzer of American BD company; Serum TNF-α, IL-6 and hs-CRP levels were detected by double sandwich enzyme-linked immunosorbent assay (ELISA), and all of the ELISA kits used in the tests were purchased from Shanghai Xinyu biological science and technology co.. All of the above operations are in strict accordance with the instrument or reagent kit with instructions.

2.4 Statistical method

We used SPSS 19.0 software package to process the test result data; mean ± standard deviation (x±s) represents measurement data, the use of t test was to compare the difference between groups, with P<0.05 as a statistically significant.

3. Results

3.1 Comparison of serum BNP, IGF-1 and IGFBP-3 levels before and after treatment in two groups

Before treatment, the levels of serum BNP, IGF-1 and IGFBP-3 in the control group were (1283.52±120.17) ng/L, (25.31±3.18) ng/mL and (0.49±0.05) ug/mL, compared with that of treatment group, there was no significant difference (P>0.05); The serum BNP levels of the two groups were significantly lower than those before treatment, and the serum levels of IGF-1 and IGFBP-3 were significantly higher than those before treatment. Among them, the levels of serum BNP, IGF-1 and IGFBP-3 in the treatment group were (481.10±70.68) ng/L, (48.89±5.11) ng/mL and (0.91±0.09) ug/mL, and the level of serum BNP was lower than that of the control group, and the serum levels of IGF-1 and IGFBP-3 were significantly higher than those of the control group (P<0.05). Please look at the table 1.

Table 1. Comparison of serum BNP, IGF-1 and IGFBP-3 levels before and after treatment in two groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Time</th>
<th>BNP (ng/L)</th>
<th>IGF-1 (ng/mL)</th>
<th>IGFBP-3 (ug/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>35</td>
<td>Before treatment</td>
<td>1283.52±120.17</td>
<td>25.31±3.18</td>
<td>0.49±0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After treatment</td>
<td>831.35±105.45</td>
<td>39.45±4.70</td>
<td>0.73±0.08</td>
</tr>
<tr>
<td>Treatment group</td>
<td>35</td>
<td>Before treatment</td>
<td>1275.34±131.56</td>
<td>26.05±3.52</td>
<td>0.50±0.06</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After treatment</td>
<td>481.10±70.68</td>
<td>48.89±5.11</td>
<td>0.91±0.09</td>
</tr>
</tbody>
</table>

Note: compared with before treatment, *P<0.05; compared with the control group, †P<0.05.
Table 2.
Comparison of serum TNF-α, IL-6 and hs-CRP levels before and after treatment in two groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Time</th>
<th>TNF-α (ng/L)</th>
<th>IL-6 (mg/L)</th>
<th>hs-CRP (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>35</td>
<td>Before treatment</td>
<td>73.65±6.02</td>
<td>70.35±5.21</td>
<td>29.54±3.89</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After treatment</td>
<td>47.33±5.16</td>
<td>35.20±3.85</td>
<td>16.47±2.51</td>
</tr>
<tr>
<td>Treatment</td>
<td>35</td>
<td>Before treatment</td>
<td>72.98±5.67</td>
<td>69.89±4.97</td>
<td>30.01±4.12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After treatment</td>
<td>38.49±4.30*</td>
<td>16.41±2.74*</td>
<td>9.73±2.01*</td>
</tr>
</tbody>
</table>

Note: compared with before treatment, *P<0.05; compared with the control group, **P<0.05.

3.2 Comparison of serum TNF-α, IL-6 and hs-CRP levels before and after treatment in two groups

Before treatment, the levels of serum TNF-α, IL-6 and hs-CRP in the control group were (73.65±6.02) ng/L, (70.35±5.21) mg/L and (29.54±3.89) mg/L. Compared with the serum levels of TNF-α, IL-6 and hs-CRP in the treatment group, there was no significant difference in serum inflammatory factors between the two groups (P>0.05). The levels of serum TNF-α, IL-6 and hs-CRP in the two groups were significantly lower than those before treatment, and the serum levels of TNF-α, IL-6 and hs-CRP in the treatment group were (38.49±4.30) ng/L, (16.41±2.74) mg/L and (9.73±2.01) mg/L. The serum inflammatory factors were significantly lower than those in the control group after treatment, and the differences were statistically significant (P<0.05). Please look at the table 2.

4. Discussion

Studies have shown that[8] the incidence of congenital heart disease is related to environment, heredity, radiation, virus infection and other factors. The mortality rate of congenital heart disease is higher than 50%. In the course of pathogenesis of congenital heart disease combined with heart failure pneumonia, the pathogen and its protein products cause the formation of micro thrombus and microcirculation disturbance in children. In addition, due to the relatively narrow lumen of the respiratory tract and the small number of alveoli, it is more prone to inflammatory lung infection, leading to a variety of inflammatory factors into the blood circulation, aggravating the related diseases[9]. The common clinical symptoms in children with congenital heart disease complicated with heart failure, pneumonia with dyspnea, cyanosis, nasal flap, irritability, three concave syndrome, lung wet rales, severe cases can cause death. Because the children's immune system has not yet developed completely, and the disease is relatively critical, so the main clinical use of oxygen, anti infection, sedation and other conservative treatment on the basis of improving the heart function of children[10-13]. Dobutamine is dopamine derivatives, a major role in the cardiac beta 1 receptor and its clinical effects are: promoting myocardial contraction and increased stroke volume; reduce peripheral vascular resistance; promote atrioventricular conduction; reduce ventricular filling pressure[14,15], Meropenem is a new type of carbapenem antibiotics, of gram positive and gram negative aerobic bacteria and anaerobic bacteria all had strong antibacterial activity, mainly in non gram positive bacteria[16-17]. This study was to explore the effect of dobutamine combined with meropenem on serum BNP, IGF-1, IGFBP-3, TNF-α, IL-6 and hs-CRP in children with congenital heart disease and pneumonia, in order to provide a safe and effective drug for clinical treatment of congenital heart disease combined with heart failure pneumonia in children with certain clinical efficacy.

The results of the study showed that there was no significant difference between the levels of serum BNP, IGF-1 and IGFBP-3 before treatment in the two groups (P>0.05); The levels of serum BNP in the two groups were significantly lower than those before treatment, and the levels of serum IGF-1 and IGFBP-3 were significantly higher than those before treatment, the level of serum BNP in the treatment group was significantly lower than that in the control group, and the serum levels of IGF-1 and IGFBP-3 were significantly higher than those of the control group, the difference was statistically significant (P<0.05). This suggests that dobutamine meropenem can significantly reduce the level of serum BNP in children with congenital heart disease complicated with heart failure and pneumonia, and elevated their serum levels of IGF-1 and IGFBP-3.BNP mainly exists in the atrium. When the volume of ventricular volume in children increases, a large number of BNP can rapidly synthesize and secrete into the blood circulation, and serum BNP is an important index to evaluate the deterioration of cardiac function[18,19]. IGF-1 is an insulin polypeptide, which plays a role in promoting neovascularization, maintaining cardiac structure and inhibiting cardiomyocyte apoptosis in children with heart failure. IGFBP-3 is the major regulator of the function and transport of insulin-like growth factors. Serum levels of IGF-1 and IGFBP-3 are important factors in the development of heart failure. Dobutamine combined with meropenem synergy, can greatly improve the cardiac function of congenital heart disease in children with pneumonia complicated with heart failure, delay ventricular remodeling, kill pathogens, which can reduce the level of serum BNP, elevate serum IGF-1 and IGFBP-3 levels[20]. In addition, the results showed that there was no significant difference in the levels of serum TNF-α, IL-6 and hs-CRP between the two groups (P>0.05); The levels of serum TNF-α, IL-6 and hs-CRP in the two groups were
significantly lower than those before treatment, and the levels of serum TNF-α, IL-6 and hs-CRP in the treatment group were significantly lower than those in the control group, the difference was statistically significant (P<0.05). This suggests that dobutamine meropenem can significantly reduce serum TNF-α, IL-6 and hs-CRP. Meropenem is the third generation of carbapenem antibiotics, the drug of choice in treatment of non gram positive bacteria, has strong antibacterial activity, thus greatly improving the inflammatory reaction, reduce serum TNF-α, IL-6 and hs-CRP [21-22].

In summary, Dobutamine combined with meropenem can significantly reduce the serum BNP, TNF-α, IL-6 and hs-CRP levels, improve serum IGF-1 and IGFBP-3 levels of children with congenital heart disease and pneumonia, and it was worthy clinical application.

Reference