Effect of fiberoptic bronchoscopic bronchoalveolar lavage with ambroxol on the SIRS and target organ damage in patients with severe pneumonia complicated by respiratory failure

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1. Introduction

Severe pneumonia refers to the lung inflammation with large lesion scope, or complicated by serious complications, and as pneumonia disease progresses, and normal ventilation/gas exchange function is impaired, patients are prone to systemic inflammatory response syndrome (SIRS), refractory hypoxemia and even respiratory failure[1,2]. Patients with severe pneumonia complicated by respiratory failure have higher mortality rate, and need to receive early and positive clinical intervention to optimize their treatment outcomes. Mechanical ventilation, anti-inflammation and son on are the other routine measures for current treatment of severe pneumonia, but studies have pointed out that above treatments alone cannot effectively inhibit disease progression and target organ damage, and therefore, many scholars recommend to add fiberoptic bronchoscopic bronchoalveolar lavage as combined treatment. Fiberoptic bronchoscopic bronchoalveolar lavage can look straight into the pulmonary lesions, remove partial secreta and inflammatory products and also conduct sensitive drug lavage to reach the goal of local treatment[3,4]. In the study, fiberoptic bronchoscopic bronchoalveolar lavage was added in the treatment of patients with severe pneumonia complicated by respiratory failure, and the curative effect was explored from SIRS severity, target organ damage and other aspects, now reported as follows.

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ABSTRACT

Objective: To study the effect of fiberoptic bronchoscopic bronchoalveolar lavage with ambroxol on the systemic inflammatory response syndrome (SIRS) and target organ damage in patients with severe pneumonia complicated by respiratory failure. Methods: A total of 68 patients with severe pneumonia complicated by respiratory failure who received inpatient treatment in our hospital between July 2013 and December 2016 were collected and then divided into the control group (n=35) who received conventional therapy and the observation group (n=33) who received fiberoptic bronchoscopic bronchoalveolar lavage with ambroxol + conventional therapy after the therapies were reviewed. The systemic inflammatory response as well as cardiac and liver function before and after treatment were compared between two groups of patients. Results: Before treatment, differences in serum levels of inflammatory factors, myocardial enzyme spectrum and liver function indexes were not statistically significant between the two groups of patients. After treatment, serum inflammatory factors IL-6, IL-8, TNF-α and CRP levels in observation group were lower than those in control group; serum myocardial enzyme spectrum LDH, α-HBDH, CKMB and cTnI levels were lower than those in control group; serum liver function index Alb content was higher than that in control group while ALP, TBA, ALT and AST contents were lower than those in control group. Conclusion: Fiberoptic bronchoscopic bronchoalveolar lavage with ambroxol can effectively reduce the degree of SIRS, and also reduce the cardiac and liver function injury in patients with severe pneumonia complicated by respiratory failure.
2. Information and methods

2.1 General information

A total of 68 patients with severe pneumonia complicated by respiratory failure who received inpatient treatment in our hospital between July 2013 and December 2016 were selected as research subjects, and the patients’ families signed consent form. The therapies were reviewed, and then the enrolled patients were divided into the control group (n=35) who received conventional therapy and the observation group (n=33) who received fiberoptic bronchoscopic bronchoalveolar lavage with ambroxol + conventional therapy. Control group included 18 men and 17 women that were 37-76 years old; observation group included 17 men and 16 women that were 38-72 years old. The gender and age distribution of the two groups were not statistically different (P>0.05).

2.2 Inclusion and exclusion criteria

Inclusion criteria: (1) in accordance with the diagnostic criteria for severe pneumonia, respiratory failure, etc.; (2) without history of severe pneumonia; (3) not receiving systematic treatment before admission; (4) with complete clinical data. Exclusion criteria: (1) combined with chronic obstructive pulmonary disease, chronic bronchitis, asthma and other respiratory disorders; (2) combined with basic heart, liver and kidney insufficiency; (3) combined with serious autoimmune diseases; (4) combined with malignant tumor disease.

2.3 Therapy

Control group of patients received clinical routine therapy for severe pneumonia complicated by respiratory failure, specifically as follows: anti-infection, spasmolysis and reducing phlegm, as well as mechanical ventilation-supported breathing when necessary.

Observation group of patients, based on routine treatment, received fiberoptic bronchoscopic bronchoalveolar lavage with ambroxol, specifically as follows: fasting for 6-8 h before treatment, intravenous diazepam (Henan Kelun Pharmaceutical Co., Ltd., approved by H41021491) 15 mg, intranasal 2% lidocaine (Guilin Pharmaceutical Co., Ltd., approved by H45020823) 15 mg in 20 mL saline to local cleaning, repeated for 2-3 times, followed by injecting the solution of ambroxol (Heilongjiang Fuhe Huaxing Pharmaceutical Shares Co., Ltd., approved by H20041024) 15 mg in 20 mL saline to local pulmonary lesions, keeping it there for 10-15 s and then sucking it out, repeated for 2-3 times. The treatment was conducted 2 times/week for 2 consecutive weeks.

2.4 Observation indexes

Before and after treatment, 3 mL of fasting cubital venous blood was extracted from both groups, anti-coagulated, then let stand at room temperature for stratification, and centrifuged at 3 500 r/min for 10 min, and upper serum was kept and cryopreserved in deep low-temperature refrigerator (French Jouan Company Suzhou office, model VXE/S (570) for test. Enzyme-linked immunosorbent (ELISA) was used to detect serum inflammatory factors interleukin-6 (IL-6), interleukin-8 (IL-8), tumor necrosis factor α (TNF-α) and C-reactive protein (CRP) levels; microplate reader (Tecan group Austria Co., Ltd., model Sunrise) was used to determine serum myocardial enzyme spectrum lactate dehydrogenase (LDH), α -hydroxybutyrate dehydrogenase (α-HBDH), creatine kinase isoenzyme (CKMB) and troponin I (cTn I) contents; ELISA was used to determine serum levels of liver function indexes albumin (Alb), alkaline phosphatase (ALP), bile acid (TBA), alanine aminotransferase (ALT) and aspartate aminotransferase (AST).

2.5 Statistical methods

The statistical software was SPSS 20.0, and the obtained data were processed by the professionals. Inflammatory factors, myocardial enzyme spectrum and liver function indexes belong to measurement data and were in terms of mean ± standard deviation, comparison within group before and after treatment was by paired t test and comparison between two groups was by grouping t test. Statistics P <0.05 indicated statistical significance in differences.

3. Results

3.1 Inflammatory factors

Comparison of serum inflammatory factors IL-6 (pg/mL), IL-8 (pg/mL), TNF-α (pg/mL) and CRP (mg/L) levels between two groups of patients before and after treatment was as follows: serum IL-6, IL-8, TNF-α and CRP levels were not significantly different between two groups of patients before treatment (P>0.05); compared with those before treatment, serum IL-6, IL-8, TNF-α and CRP levels in both groups decreased significantly after treatment; compared with those in control group, serum IL-6, IL-8, TNF-α and CRP levels in observation group decreased significantly after treatment (P<0.05), shown in Table 1.

Table 1.

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>Time</th>
<th>IL-6 (pg/mL)</th>
<th>IL-8 (pg/mL)</th>
<th>TNF-α (pg/mL)</th>
<th>CRP (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>35</td>
<td>Before treatment</td>
<td>173.29±20.65</td>
<td>90.23±10.55</td>
<td>32.13±4.02</td>
<td>45.38±5.72</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After treatment</td>
<td>87.23±9.32</td>
<td>37.19±4.67</td>
<td>16.15±2.04</td>
<td>18.94±2.11</td>
</tr>
<tr>
<td>Observation</td>
<td>33</td>
<td>Before treatment</td>
<td>172.53±21.04</td>
<td>91.51±9.84</td>
<td>33.27±4.53</td>
<td>45.29±5.86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After treatment</td>
<td>21.18±2.93</td>
<td>18.65±2.04</td>
<td>9.62±1.01</td>
<td>10.52±1.76</td>
</tr>
</tbody>
</table>

Note: compared with same group before treatment, *P<0.05; compared with control group after treatment, *P<0.05.
Comparison of serum liver function indexes between two groups of patients before and after treatment (U/L).

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>Time</th>
<th>Alb (g/L)</th>
<th>ALP (U/L)</th>
<th>TBA (μmol/L)</th>
<th>ALT (U/L)</th>
<th>AST (U/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>35</td>
<td>Before</td>
<td>48.63±5.18</td>
<td>213.28±25.79</td>
<td>34.82±4.11</td>
<td>92.15±10.64</td>
<td>101.29±14.67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After</td>
<td>70.79±8.23</td>
<td>92.36±10.15</td>
<td>20.17±2.54</td>
<td>45.72±5.88</td>
<td>58.62±7.19</td>
</tr>
<tr>
<td>Observation group</td>
<td>33</td>
<td>Before</td>
<td>48.47±5.23</td>
<td>214.17±26.88</td>
<td>34.76±4.09</td>
<td>92.34±11.17</td>
<td>102.15±17.48</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After</td>
<td>98.66±10.41</td>
<td>39.26±4.52</td>
<td>11.46±1.85</td>
<td>21.82±2.75</td>
<td>24.31±3.04</td>
</tr>
</tbody>
</table>

Note: compared with same group before treatment, *P<0.05; compared with control group after treatment, #P<0.05.

3.2 Myocardial enzyme spectrum

Comparison of serum myocardial enzyme spectrum LDH, α-HBDH, CKMB and cTn I levels between two groups of patients before and after treatment as follows: serum LDH, α-HBDH, CKMB and cTn I levels were not significantly different between two groups of patients before treatment (P>0.05); compared with those before treatment, serum LDH, α-HBDH, CKMB and cTn I levels in both groups decreased significantly after treatment; compared with those in control group, serum LDH, α-HBDH, CKMB and cTn I levels in observation group decreased significantly after treatment (P<0.05), shown in Table 2.

3.3 Liver function indexes

Comparison of serum liver function indexes Alb (g/L), ALP (U/L), TBA (μmol/L), ALT (U/L) and AST (U/L) levels between two groups of patients before and after treatment as follows: serum Alb, ALP, TBA, ALT and AST levels were not significantly different between two groups of patients before treatment (P>0.05); compared with those before treatment, serum Alb contents in both groups increased significantly while ALP, TBA, ALT and AST contents decreased significantly after treatment; compared with those in control group, serum Alb content in observation group increased significantly while ALP, TBA, ALT and AST contents decreased significantly after treatment (P<0.05), shown in Table 3.

4. Discussion

Patients with severe pneumonia are easily combined with respiratory failure, severe SIRS can constantly attack important tissue organs and aggravate illness, and how to effectively treat severe pneumonia and optimize treatment outcome is the focus and difficulty in clinical research. Conventional mechanical ventilation support and intravenous anti-infection treatment help to alleviate the patient's clinical symptoms, but they are weak in completely preventing disease progression, protecting target organ function and other aspects, which is mainly directly because that the pulmonary secretion blocking leads to local alveolar occlusion and blood supply reduction, and intravenous drugs are difficult to reach lesions[5,6]. Fiberoptic bronchoscopy can look directly into the pulmonary lesions and provide local medication, and it has become the new method for treating severe pneumonia. Ambroxol is an expectorant with good phlegm-dissolve, respiratory tract-lubricating and other effects, and fiberoptic bronchoscopic local pulmonary ambroxol application is with high local drug concentration and more significant phlegm-reducing effect, so many scholars now recommend adding fiberoptic bronchoscopic bronchoalveolar lavage with ambroxol in the overall therapy for patients with severe pneumonia[7].

Massively secretion of inflammatory cytokines and the resulting inflammatory cascade reaction are the pathogenesis of SIRS, and inflammatory cytokine levels in circulating blood of patients with severe pneumonia is closely related to the disease severity and treatment outcome, so the detection of serum levels of typical inflammatory factors can be the reliable method to judge the disease condition and evaluate the clinical therapeutic effect[8,9]. IL-6 and IL-8 are the most commonly studied interleukins at present, which are secreted by mononuclear macrophages early after pathogen infection, and can further induce increased generation of TNF-α, CRP and other pro-inflammatory factors, prompt a large number of neutrophils to gather in local pulmonary lesions, and increase the lung tissue damage[10,11]. In the study, serum levels of these inflammatory cytokines were compared two groups of patients, and it was found that compared with those before treatment, serum IL-6, IL-8, TNF-α and CRP levels in both groups of patients were lower after treatment, indicating that both therapies can reduce systemic inflammatory response in patients with severe pneumonia to different degree; further compared with the control group, observation group were with lower serum IL-6, IL-8, TNF-α and CRP levels after treatment, confirming that adding fiberoptic bronchoscopic
bronchoalveolar lavage with ambroxol can more effectively reduce the SIRS severity, and this is mainly directly because that the pulmonary lesions are cleared, ventilation/gas exchange function is improved, and so on.

Target organ damage is the important cause of common pneumonia progression to severe pneumonia, the heart is the most easily involved viscera in patients with severe pneumonia, and it is related to direct pathogen attack on myocardial cells and inflammatory factor damage to myocardial cells[12,13]. Myocardial enzyme spectrum is the most common and the most reliable indicator to reflect myocardial injury, the content is very low in the serum under physiological state, a large number of specific indicators are released into the blood and are detected after myocardial injury, and their level are highly consistent with the degree of myocardial injury[14,15]. In the study, serum levels of myocardial enzyme spectrum LDH, α-HBDH, CKMB and cTn I contents in both groups of patients were lower after treatment, showing that two treatments can relieve myocardial injury; further compared with control group, observation group of patients were with lower serum levels of myocardial enzyme spectrum LDH, α-HBDH, CKMB and cTn I levels after treatment, showing that adding fiberoptic bronchoscopic bronchoalveolar lavage with ambroxol can more effectively reduce myocardial injury, and this is directly related to the removal of pathogenic bacteria and inflammatory factors.

Liver is also the easily damaged target organ in patients with severe pneumonia, liver cell damage can lead to intracellular specific factor release into the blood, and its functions such as metabolizing fatty acid and producing albumin are weakened, leading to the abnormality of a series of states[16,17]. It was found in the study that compared with those before treatment, the Alb levels in both groups of patients were higher while ALP, TBA, ALT and AST levels were lower after treatment; further compared with control group, the observation group of patients were with higher serum Alb content and lower ALT, AST, ALP and TBA contents after treatment, showing that fiberoptic bronchoscopic bronchoalveolar lavage with ambroxol can effectively reduce the liver cell function damage.

To sum up, it is concluded that fiberoptic bronchoscopic bronchoalveolar lavage with ambroxol for patients with severe pneumonia helps to reduce the degree of SIRS and protect the heart and liver function, is a highly efficient and reliable means of adjuvant therapy, and is worthy of popularization and application in clinical practice in the future.

References


