Improving effect of sputum aspiration combined with bronchoalveolar lavage by fiber bronchoscope on the condition and inflammation in lung cancer patients with postoperative pulmonary infection

Jin-Yi Min, Xian-Wei Wu, Xiao-Yuan Xiang, Lei Chen, Yuan-Yuan Hu
ICU, Dangyang Changbanpo Hospital of Hubei Province, Yichang City, Hubei Province, 444100

1. Introduction

The postoperative coughing and expectorating ability reduces in patients with lung cancer, and the immune function is inhibited to a certain degree after surgical trauma, leading to secretion accumulating and pathogenic bacteria breeding in the lung and forming pulmonary infection. Pulmonary infection after lung cancer surgery will increase the surgical trauma, and surgical trauma can lead to protracted course of infection, forming a vicious circle [1,2]. Intravenous application of antibiotics alone cannot reach the effective concentration in the lungs, the sterilization effect is not strong, and the existing domestic studies have reported the positive effects of sputum aspiration combined with bronchoalveolar lavage by fiber bronchoscope for severe pulmonary infection [3,4].

Bronchoalveolar lavage by fiber bronchoscope can dilute and suck the sticky secretions and restore the airway patency, and meantime, local application of high-concentration antiseptic drugs can enhance the antibacterial and sterilizing effect, and enhance anti-infection effect. At present, there is still no clear report about the curative effect of sputum aspiration combined with bronchoalveolar lavage by bronchoscope for lung cancer patients with postoperative pulmonary infection. In the study, the improving effect of sputum aspiration combined with bronchoalveolar lavage by fiber bronchoscope on the condition and inflammation in lung cancer patients with postoperative pulmonary infection was mainly analyzed, now reported as follows.

2. Information and methods

2.1. General information
A total of 78 patients with lung cancer who received surgical treatment in our hospital between August 2013 and January 2015 and were with postoperative infection were selected as the research subjects, all patients were diagnosed with lung cancer by preoperative pathology biopsy and conformed to the indications of surgical resection, and patients complicated with preoperative infection were excluded. The included patients were randomly divided into observation group and control group (n=39). Control group included 20 male cases and 19 female cases that were 45-72 years old and (65.82±6.05) years old in average; observation group included 21 male cases and 18 female cases that were 44-70 years old and (64.19±5.87) years old in average. The two groups of patients were not statistically different in general information, P>0.05.

2.2. Treatment methods

Both groups of patients received positive anti-infection treatment, including antibiotics, eliminating phlegm, airway secretion drainage, electrolyte disorder correction, nutritional support, etc. Control group received mechanical ventilation therapy, patients’ weight, ventilation conditions and blood gas results were referred to regulate the fraction of inspired oxygen, tidal volume, respiratory frequency, positive end-expiratory pressure (PEEP) levels, etc., and discontinuous phlegm suction should be paid attention to during mechanical ventilation. Observation group received bronchoalveolar lavage by bronchoscope combined with mechanical ventilation, specifically as follows: the bronchoscope body was embedded via tracheal catheter under bedside direct vision, the chest CT and the findings from bronchoscope were referred to determine the infected pulmonary lobe and pulmonary segments, the bronchoscope body was used to suck the secretions after it entered the bronchial opening of corresponding pulmonary lobe and pulmonary segments, and sputum specimens were collected for drug sensitive test. For sticky sputum that couldn’t be sucked out easily, 10-20 mL warm saline was used for lavage, the operation was repeated, negative pressure was less than 200 mmHg, there should be no secretion residua in the bronchus of left and right lobe segments, and if there was residua, it should continue to be sucked until clearance.

2.3. Observation indexes

3 d after treatment, peripheral blood samples were collected from two groups of patients and centrifuged to get serum, and then enzyme-linked immunosorbent assay (ELISA) was used to detect hypersensitive C-reactive protein (hs-CRP), tumor necrosis factor (TNF-α), interleukin-8 (IL-8), procalcitonin (PCT), rennin (R), angiotensin II (AngII) and aldosterone (ALD) content.

2.3.1. Serum indexes

3 d after treatment, peripheral blood samples were collected from two groups of patients and centrifuged to get serum, and then enzyme-linked immunosorbent assay (ELISA) was used to detect hypersensitive C-reactive protein (hs-CRP), tumor necrosis factor (TNF-α), interleukin-8 (IL-8), procalcitonin (PCT), rennin (R), angiotensin II (AngII) and aldosterone (ALD) content.

2.3.2. Respiratory mechanics indexes

Respiratory mechanics indexes of the two groups of patients were determined after treatment, including the peak inspiratory pressure (PIP), dynamic compliance (Cdyn), airway resistance (Raw) and work of breathing (WOB).

2.4. Statistical methods

SPSS 21.0 software package was used for statistical analysis, measurement data analysis between two groups was by t test and P<0.05 indicated statistical significance in differences.

3. Results

3.1. Serum inflammatory factor levels

3 d after treatment, analysis of serum inflammatory factors hs-CRP, TNF-α, IL-8 and PCT between two groups of patients was as follows: serum hs-CRP, TNF-α, IL-8 and PCT levels of observation group were significantly lower than those of control group. Differences in serum hs-CRP, TNF-α, IL-8 and PCT levels were statistically significant between two groups of patients 3 d after treatment (P<0.05), shown in Table 1.

2.3. RAS system activity

3 d after treatment, analysis of serum RAS system molecules renin, angiotensin II and aldosterone between two groups of patients was as follows: serum renin, angiotensin II and aldosterone levels of observation group were significantly lower than those of control group. Differences in serum renin, angiotensin II and aldosterone levels were statistically significant between two groups of patients 3

Table 1

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>hs-CRP (mg/L)</th>
<th>TNF-α (pg/mL)</th>
<th>IL-8 (pg/mL)</th>
<th>PCT (pg/mL)</th>
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</thead>
<tbody>
<tr>
<td>Observation</td>
<td>39</td>
<td>37.11±6.32</td>
<td>12.04±1.73</td>
<td>100.04±8.53</td>
<td>15.38±2.42</td>
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<tr>
<td>Control</td>
<td>39</td>
<td>67.27±7.51</td>
<td>23.18±3.69</td>
<td>141.63±11.82</td>
<td>21.84±3.05</td>
</tr>
<tr>
<td>T</td>
<td>7.485</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</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>&lt;0.05</td>
</tr>
</tbody>
</table>
days after treatment (P<0.05), shown in Table 2.

### Table 2
Comparison of RAS system activity between two groups of patients after treatment (pg/mL).

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>R</th>
<th>AngII</th>
<th>ALD</th>
</tr>
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<tbody>
<tr>
<td>Observation</td>
<td>39</td>
<td>1.31±0.17</td>
<td>24.37±3.26</td>
<td>54.25±6.26</td>
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<tr>
<td>Control</td>
<td>39</td>
<td>1.98±0.23</td>
<td>36.15±4.67</td>
<td>78.32±8.93</td>
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<tr>
<td>t</td>
<td></td>
<td>6.978</td>
<td>7.137</td>
<td>7.684</td>
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<tr>
<td>P</td>
<td></td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

#### 3.3. Respiratory mechanics indexes

3 d after treatment, analysis of respiratory mechanics indexes PIP, Raw, WOB and Cdyn between two groups of patients was as follows: PIP, Raw and WOB levels of observation group were significantly lower than those of control group while Cdyn level was significantly higher than that of control group. Differences in PIP, Raw, WOB and Cdyn levels were statistically significant between two groups of patients 3 days after treatment (P<0.05), shown in Table 3.

### Table 3
Comparison of respiratory mechanics index values between two groups of patients after treatment.

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>PIP (cmH2O)</th>
<th>Cdyn (mL/cmH2O)</th>
<th>Raw [cmH2O(L·S)]</th>
<th>WOB (J/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>39</td>
<td>16.28±1.34</td>
<td>36.72±2.99</td>
<td>8.17±0.67</td>
<td>0.32±0.04</td>
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<tr>
<td>Control</td>
<td>39</td>
<td>25.95±1.98</td>
<td>27.48±2.05</td>
<td>12.15±1.09</td>
<td>0.56±0.05</td>
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<tr>
<td>t</td>
<td></td>
<td>7.92</td>
<td>9.73</td>
<td>6.13</td>
<td>6.05</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
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</table>

#### 4. Discussion

Due to the long-term immobility as well as the declined resistance and airway function, patients with lung cancer surgery have multiplied chance of developing pulmonary infection. Lung cancer patients with postoperative pulmonary infection are mostly severely ill and difficult to treat, and because the lungs go through surgical trauma and the basic lung function declines, patients’ respiratory function further reduces after pulmonary infection, and they mostly have the symptoms such as difficulty in expectoration and breathing, and often need mechanical ventilation support[5]. In the traditional treatment, patients with mechanical ventilation will receive intravenous systemic medication at the same time, long-term wide application of antimicrobial agents can increase the formation of drug-resistant strains to some extent, and the protracted course of disease increases the risk of nosocomial double infection. Due to the difficulty of expectoration in lung cancer patients with postoperative pulmonary infection, there are secretion blockage and other circumstances in the lungs, there are also local lung tissue ischemia, hypoxia, and so on and so forth, so few intravenous drug reaches the lesions, it is difficult to achieve the effective drug concentration of sterilization, and the therapeutic effect is not ideal[6,7].

Looking for a more direct and effective treatment is currently much-needed for lung cancer patients with postoperative pulmonary infection, and the pulmonary local treatment by fiber bronchoscope is highly praised at present. Fiber bronchoscope can enter into the local lungs and be accurately positioned in the lesion with the help of radiological technology, and it can not only effectively remove all kinds of pathogenic microorganisms and achieve the anti-infection purpose, but can also retain secretion samples for drug sensitivity test and provide guidance for subsequent rational use of antibiotics[8,9].

Bronchoalveolar lavage technology via fiber bronchoscope has the effects such as relieving airway obstruction, local high-concentration drug therapy and sputum culture, and the saline was adopted for the lavage and has no adverse effect on the lung tissue. Most scholars agree that for patients with more secretions and poor effect of long-term intravenous treatment, bronchoalveolar lavage therapy by fiber bronchoscope is reasonable and effective[10,11], and therefore, the technology was applied in the study in lung cancer patients with postoperative pulmonary infection, and then analyzed from the inflammation levels, stress levels, respiratory mechanics and other aspects.

There is already huge trauma and stress in lung cancer surgery, the postoperative pulmonary infection increases the systemic inflammatory state in patients, and such patients are mainly characterized by the sharp rise in the levels of all kinds of proinflammatory factors[12,13]. Hypersensitive C-reactive protein (hs-CRP) is the most sensitive indicator of inflammation, its levels can rise sharply in the early inflammation, and it can reflect the progress and outcome of the disease in real time. Both tumor necrosis factor (TNF-α) and interleukin-8 (IL-8) are the main proinflammatory factors, and as the disease progresses, the above factors will be massively released, further recruit the release of other inflammatory factors and play an important role in the inflammatory cascade reaction[14]. Procalcitonin (PCT) is the latest inflammation-related factor, and a study shows that in the case of acute inflammatory reaction, PCT levels can increase with it accordingly, it is another sensitive index to reflect the body’s inflammatory state, and its specificity is high[15]. The study results showed that serum hs-CRP, TNF-α, IL-8 and PCT levels of observation group were lower
after treatment, indicating that bronchoalveolar lavage by fiber bronchoscope can significantly reduce the systemic inflammatory stress state in patients, and showing the significant antiseptic effect of local high-concentration antibiotic application.

Lung cancer patients with postoperative pulmonary infection are mostly with severe respiratory dysfunction, which is mainly characterized by both pulmonary ventilation and pulmonary exchange dysfunction. In the study, peak inspiratory pressure (PIP), airway resistance (Raw) and work of breathing (WOB) of observation group were lower while dynamic compliance (Cdyn) was higher after treatment, indicating that after the bronchoalveolar lavage by fiber bronchoscope, the secretions in the lungs are sucked out or diluted, airway resistance greatly reduces, and therefore, the peak inspiratory pressure and work of breathing also significantly reduce accordingly; application of high-concentration antibiotics for sterilization within local lung lesions will significantly enhance the killing effect on pathogenic bacteria, prevent it from further damaging the respiratory function and optimize the pulmonary ventilation function, so the dynamic lung compliance is improved [10,11]. The above results show that the bronchoalveolar lavage by fiber bronchoscope can optimize both ventilation and exchange function in lung cancer patients with postoperative pulmonary infection.

To sum up, for lung cancer patients with postoperative pulmonary infection, bronchoalveolar lavage by bronchoscope combined with mechanical ventilation can optimize patients’ condition, relieve inflammatory response and improve respiratory function.

References


