Effect of sufentanil combined with propofol and scoline on stress response and immune response in fiberoptic bronchoscopy

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ABSTRACT

Objective: To explore the effect of sufentanil combined with propofol and scoline on stress response and immune response in fiberoptic bronchoscopy. Methods: A total of 138 patients with fiberoptic bronchoscopy in the hospital between March 2015 and April 2017 were collected and divided into routine group and scoline group by random number table, 69 cases in each group. Routine group received sufentanil combined with propofol anesthesia, and scoline group received sufentanil, propofol combined with scoline anesthesia. The differences in the levels of stress hormones in serum and immune indexes in alveolar lavage fluid were compared between the two groups before and after examination. Results: Before examination, the differences in the levels of Th1/Th2 cytokines in serum as well as Th1/Th2 cytokines and Th17/Treg cytokines in alveolar lavage fluid were not statistically significant between the two groups; immediately after examination, serum stress hormones Cor, E and NE levels of scoline group were lower than those of routine group; Th1 cytokines IL-2 and IFN-γ levels in alveolar lavage fluid were higher than those of routine group while Th2 cytokines IL-10 and IL-13 levels were lower than those of routine group; Th17 cytokine IL-17 level in alveolar lavage fluid was lower than that of routine group while Treg cytokine IL-23 level was higher than that of routine group. Conclusion: Small-dose scoline for fiberoptic bronchoscopy anesthesia can effectively relieve the systemic stress state and avoid the acute injury of immune response function.

1. Introduction

Fiberoptic bronchoscopy is an important auxiliary means of diagnosis for clinical respiratory tract-related diseases. With the gradual popularization of comfortable medical concept, the painless fiberoptic bronchoscopy technology has received much attention at present, and how to maintain full oxygenation and homeostasis during inspection is the key of the contemporary study of anesthesia[1,2]. Both sufentanil and propofol are common intravenous anesthetics during fiberoptic bronchoscopy, and they can maintain patients at a certain depth of sedation and reduce the violent circulation fluctuation caused by airway stimulation[3-4]. At present, many studies have shown that sedative and anesthetic drugs alone for fiberoptic bronchoscopy can make the patients in a relatively sedative state, but under the non-muscle-relaxing condition, the glottis opening is poor, bronchofiberscope imbedding is difficult, and airway muscle spasm can lead to poor inspection vision. Scoline is a tubocurarine synthetic substitute, which has the advantages such as fast muscle-relaxing effect and short duration, and is the common drug for rapid intubation of little surgery[5,6]. It was used together in the study for fiberoptic bronchoscopy anesthesia, and the effect of small-dose scoline application on the stress response and immune status was discussed.
2. Information and methods

2.1 Case information

A total of 138 patients with fiberoptic bronchoscopy in the hospital between March 2015 and April 2017 were selected, and the patients themselves or their families signed informed consent. The random number table method was used to divide the patients into routine group and scoline group, 69 cases in each group. Routine group included 36 male cases and 33 female cases that were 23-71 years old; scoline group included 35 male cases and 34 female cases that were 25-69 years old. The baseline data were not significantly different between the two groups, follow-up data were comparable, and the study was discussed and approved by the hospital ethics committee.

2.2 Inclusion criteria

(1) Tolerating fiberoptic bronchoscopy; (2) without history of fiberoptic bronchoscopy; (3) fully cooperating and completing the related inspection items.

2.3 Exclusion criteria

(1) Combined with asthma and other pulmonary basic diseases; (2) with general anesthesia history within 6 months prior to admission; (3) allergic to sufentanil, propofol and scoline; (4) combined with basic autoimmune diseases; (5) combined with hyperthyroidism, hypothyroidism and other diseases affecting basic metabolism; (6) with long-term use of glucocorticoids.

2.4 Anesthesia methods

Routine group received sufentanil combined with propofol anesthesia, which was as follows: monitoring ECG, noninvasive blood pressure and other vital signs after patients entered the room, 2.5 mg/kg propofol and 0.3 μg/kg sufentanil for anesthesia induction, and sevoflurane inhalation anesthesia to maintain anesthesia depth at 1.3 MAC.

Scoline group received sufentanil and propofol combined with small-dose scoline for anesthesia, and the methods were as follows: the usage and dosage of sufentanil and propofol were the same as those of routine group, and the anesthesia induction was joined by 0.6 mg/kg scoline.

2.5 Stress indexes

Before inspection and immediately after inspection, right amount of peripheral venous blood was extracted from two groups of patients, anti-coagulated and then centrifuged to get the upper serum, and RIA method was used to detect the contents of stress indexes cortisol (Cor), epinephrine (E) and norepinephrine (NE).

2.6 Immune response indexes

Before inspection and immediately after inspection, alveolar lavage fluid was collected from the two groups and centrifuged to get supernatant, enzyme-linked immunosorbent assay method was used to detect the levels of Th1/Th2 cytokines and Th17/Treg cytokines, including Th1 cytokines interleukin-2 (IL-2) and interferon-γ (IFN-γ), Th2 cytokines interleukin-10 (IL-10) and interleukin-13 (IL-13), Th17 cytokine interleukin-17 (IL-17) and Treg cytokine interleukin-23 (IL-23).

2.7 Statistical methods

Stress indexes, Th1/Th2 cytokines and Th17/Treg cytokines were all in terms of mean ± standard deviation, and the respective comparison before and after inspection as well as the comparison within group was all by t test. Data input and calculate software in the study was SPSS 25.0 and \( P < 0.05 \) indicated statistical significance in differences in the obtained statistics.

3. Results

3.1 Stress hormones

Comparison of serum stress hormones Cor, E and NE levels between the two groups before and after examination was as follows: before examination, the differences in serum Cor, E and NE levels were not statistically significant between the two groups (\( P > 0.05 \)). Immediately after examination, serum Cor, E and NE levels of both groups were higher than those before examination, and serum Cor, E and NE levels of scoline group were lower than those of routine group (\( P < 0.05 \)), shown in Table 1.

<table>
<thead>
<tr>
<th>Groups</th>
<th>( n )</th>
<th>Cor Before examination</th>
<th>Cor Immediately after examination</th>
<th>E Before examination</th>
<th>E Immediately after examination</th>
<th>NE Before examination</th>
<th>NE Immediately after examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine group</td>
<td>69</td>
<td>20.19±2.88</td>
<td>52.57±6.18</td>
<td>94.27±10.54</td>
<td>130.38±15.79</td>
<td>174.82±22.69</td>
<td>295.37±35.18</td>
</tr>
<tr>
<td>Scoline group</td>
<td>69</td>
<td>20.53±2.76</td>
<td>31.09±4.52</td>
<td>94.38±11.26</td>
<td>114.76±13.58</td>
<td>173.75±19.64</td>
<td>210.66±24.52</td>
</tr>
<tr>
<td>( t )</td>
<td></td>
<td></td>
<td>0.182</td>
<td>11.823</td>
<td>0.264</td>
<td>10.948</td>
<td>0.179</td>
</tr>
<tr>
<td>( P )</td>
<td></td>
<td>( &gt;0.05 )</td>
<td>( &lt;0.05 )</td>
<td>( &gt;0.05 )</td>
<td>( &lt;0.05 )</td>
<td>( &gt;0.05 )</td>
<td>( &lt;0.05 )</td>
</tr>
</tbody>
</table>

Note: compared with same group before examination, \( *P < 0.05 \).
Comparison of Th1/Th2 cytokine levels in alveolar lavage fluid before and after examination (pg/mL).

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>IL-2 Before examination</th>
<th>IL-2 Immediately after examination</th>
<th>IFN-γ Before examination</th>
<th>IFN-γ Immediately after examination</th>
<th>IL-10 Before examination</th>
<th>IL-10 Immediately after examination</th>
<th>IL-13 Before examination</th>
<th>IL-13 Immediately after examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine</td>
<td>69</td>
<td>11.28±1.95</td>
<td>7.05±0.81</td>
<td>9.28±0.97</td>
<td>6.05±0.68</td>
<td>14.27±1.89</td>
<td>21.59±2.88</td>
<td>7.38±0.85</td>
<td>12.65±1.74</td>
</tr>
<tr>
<td>Scoline</td>
<td>69</td>
<td>11.43±1.86</td>
<td>9.16±0.98</td>
<td>9.34±0.95</td>
<td>8.11±0.89</td>
<td>14.63±1.95</td>
<td>17.05±2.14</td>
<td>7.41±0.96</td>
<td>9.07±1.42</td>
</tr>
<tr>
<td>t</td>
<td></td>
<td>0.182</td>
<td>0.918</td>
<td>0.264</td>
<td>8.627</td>
<td>0.179</td>
<td>0.114</td>
<td>0.265</td>
<td>0.973</td>
</tr>
<tr>
<td>p</td>
<td></td>
<td>&gt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&gt;0.05</td>
<td>&lt;0.05</td>
<td>&gt;0.05</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

Note: compared with same group before examination, *P*<0.05.

3.2 Th1/Th2 cytokines

Comparison of Th1 cytokines IL-2 and IFN-γ as well as Th2 cytokines IL-10 and IL-13 levels in alveolar lavage fluid between the two groups before and after examination was as follows: before examination, the differences in IL-2, IFN-γ, IL-10 and IL-13 levels in alveolar lavage fluid were not significant between the two groups (*P*>0.05). Immediately after examination, IL-2 and IFN-γ levels in alveolar lavage fluid of both groups were lower than those before examination while IL-10 and IL-13 levels were higher than those before examination; IL-2 and IFN-γ levels in alveolar lavage fluid of scoline group were higher than those of routine group while IL-10 and IL-13 levels were lower than those of routine group (*P*<0.05), shown in Table 2.

3.3 Th17/Treg cytokines

Comparison of Th17 cytokine IL-17 and Treg cytokine IL-23 levels in alveolar lavage fluid between the two groups before and after examination was as follows: before examination, the differences in IL-17 and IL-23 levels in alveolar lavage fluid were not significant between the two groups of patients (*P*>0.05). Immediately after examination, IL-17 levels in alveolar lavage fluid of both groups were higher than those before examination while IL-23 levels were lower than those before examination; IL-17 level in alveolar lavage fluid of scoline group was lower than that of routine group while IL-23 level was higher than that of routine group (*P*<0.05), shown in Table 3.

Table 3. Comparison of Th17/Treg cytokine levels in alveolar lavage fluid before and after examination (pg/mL).

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>IL-17 Before examination</th>
<th>IL-17 Immediately after examination</th>
<th>IL-23 Before examination</th>
<th>IL-23 Immediately after examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine</td>
<td>69</td>
<td>15.38±2.11</td>
<td>34.72±4.51</td>
<td>9.61±1.53</td>
<td>6.48±0.71</td>
</tr>
<tr>
<td>Scoline</td>
<td>69</td>
<td>15.19±2.07</td>
<td>22.85±2.79</td>
<td>9.48±1.49</td>
<td>8.05±0.87</td>
</tr>
<tr>
<td>t</td>
<td></td>
<td>0.183</td>
<td>15.382</td>
<td>0.216</td>
<td>8.923</td>
</tr>
<tr>
<td>p</td>
<td></td>
<td>&gt;0.05</td>
<td>&lt;0.05</td>
<td>&gt;0.05</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

Note: compared with same group before examination, *P*<0.05.

4. Discussion

Fiberoptic bronchoscopy belongs to clinical little operation, bronchofiberscope enters the airway via glottis and causes strong stimulation, it can cause severe cough reflex and circulatory system fluctuation, and some patients can even develop cardiac arrest[7–9]. Choosing reasonable way of anesthesia to inhibit operation stimulation and ensure the patients’ life safety during inspection is the basic requirement for current fiberoptic bronchoscopic, sufentanil is the analgesic applied to μ receptor, propofol is alkyl-based short-acting intravenous anesthetic, and the combination of the two can make the patients in a sedative state during inspection and weaken the body reaction to fiberoptic bronchoscopy[10,11]. However, with gradual popularization of fiberoptic bronchoscopy, many cases have shown that patients still have a severe cough reaction after active intravenous anesthesia, and some patients even terminate the examination. Small-dose anesthetics has become a new subject of fiberoptic bronchoscopy anesthesia for inhibiting muscle reflex, and scoline, as one of the most controllable muscle relaxants has received attention again[12]. In the research, small-dose scoline combined with sufentanil and propofol was used for clinical anesthesia of patients with fiberoptic bronchoscopy, and the effect of the combination of the three drugs on the systemic stress reaction and immune response during inspection was discussed to provide a reference for selecting anesthesia method for subsequent similar inspection.

Bronchofiberscope stimulation to throat as well as tracheal and bronchial wall can lead to severe cough reflex in patients and cause rapid rise in blood pressure and heart rate, and serious cases even develop cardiac arrest because of violent stimulation. During fiberoptic bronchoscopy, the circulation fluctuations can cause a variety of stress hormones to be secreted into the blood quickly, they further promote blood pressure and heart rate to change, the two forms a vicious cycle, and the levels of stress hormones in the circulating blood can objectively reflect the stimulation degree of fiberoptic bronchoscopy and the feasibility of anesthesia plan[13,14].

Cor, E and NE are the most typical stress hormones. Under the stimuli such as infection and trauma, the adrenal cortex and medulla secrete the above stress hormones and participate in the circulatory fluctuation[15,16]. It was found in the study that compared with those before examination, serum Cor, E and NE levels of both groups of patients were higher immediately after examination, showing that the fiberoptic bronchoscopy under different anesthetic solutions can both cause stress state; further compared with those of routine group, serum Cor, E and NE levels of scoline group were lower, indicating that adding small-dose scoline in the anesthetic scheme can reduce the muscle reflex under fiberoptic bronchoscopy stimulation and the resulting stress reaction.

Fiberoptic bronchoscopy is an invasive operation, and its intraoperative stimulation to the patients and the resulting stress can directly affect the immune response state during examination. Generally speaking, Th1 cells are generally in function inhibition condition under stress state, the levels of cytokines IL-2 and IFN-γ...
secreted by them also decrease, the T cell mitosis is suppressed and cell immune function declines, Th1 cell differentiation to Th2 cells is accelerated at the same time, and the secretion of Th2 cytokines IL-10 and IL-13 increases[17,18]. It was found in the study that compared with those before examination, IL-2 and IFN-γ levels in alveolar lavage fluid of both groups were lower while IL-10 and IL-13 levels were higher immediately after examination, which is consistent with the Th1/Th2 cellular immune imbalance under stress state; further compared with those of routine group, IL-2 and IFN-γ levels in alveolar lavage fluid of scoline group were higher while IL-10 and IL-13 levels were lower, confirming that small-dose scoline for muscle relaxing can reduce the body’s stress response and relieve the Th1/Th2 immune imbalance.

The stress response can stimulate the function of Th17 cells and accelerate them to secrete effector molecule IL-17, which further stimulates the secretion of IL-6, TNF-α and other pro-inflammatory factors, and enhances local inflammatory stress response[19]. Treg is an inhibitory T cell subset that mainly secretes IL-23 and has the effect of localizing inflammatory response, and it has found that Treg cells are lowly expressed in patients with infection and trauma[20]. It was found in the study that compared with those before examination, IL-17 levels in alveolar lavage fluid of both groups of patients were higher while IL-23 levels were lower immediately after examination, confirming that fiberoptic bronchoscopy can lead to Th17/Treg immune imbalance; further compared with those of routine group, IL-17 level in alveolar lavage fluid of scoline group was higher while IL-23 level was higher after examination, indicating that airway muscle tissue relaxing by scoline can effectively reduce the degree of Th17/Treg immune imbalance and optimize the normal immune response process.

The application of sufentanil and propofol combined with small-dose scoline anesthesia during fiberoptic bronchoscopy can effectively relieve the stress response during the inspection and reduce the inhibitory effect on normal immune response, is a reliable anesthesia way for fiberoptic bronchoscopy, and is worth popularization and application in clinical practice in the future.

References