Effect of etomidate combined with propofol on stress and inflammatory response in painless gastrointestinal endoscopy

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ABSTRACT

Objective: To study the effect of etomidate combined with propofol on stress and inflammatory response in painless gastrointestinal endoscopy. Methods: A total of 380 subjects who received painless gastrointestinal endoscopy in the hospital were selected as the research subjects and divided into control group and observation group by random number table, 190 cases in each group. Control group received propofol intravenous anesthesia, and observation group received etomidate combined with propofol intravenous anesthesia. The differences in serum levels of stress indexes and inflammatory factors were compared between the two groups 24 h before examination, during examination and 1 h after examination. Results: 24 h before examination, difference in serum levels of stress indexes and inflammatory factors were not statistically significant between the two groups of subjects. During examination and 1 h after examination, difference in serum levels of stress indexes and inflammatory factors were not statistically significant between the two groups of subjects. During examination and 1 h after examination, serum NE, E, Cor, ALD, IL-1β, IL-4, IL-6, IL-8, IL-10 and TNF-α contents of both groups were higher than those 24 h before examination, and serum NE, E, Cor, ALD, IL-1β, IL-4, IL-6, IL-8, IL-10 and TNF-α contents of observation group were lower than those of control group. Conclusion: Etomidate combined with propofol for painless gastrointestinal endoscopy can effectively alleviate the stress and inflammatory response during and early after the examination.

1. Introduction

Painless gastrointestinal endoscopy is a routine method for clinical physical examination and gastrointestinal disease diagnosis, intravenously infusing anesthetics to make the subjects in sedation state is the most common way of anesthesia at present, and it can smoothen the hemodynamics during examination and reduce the stimulation of related operations to the body[1,2]. Propofol is the most popular intravenous anesthetic in painless gastrointestinal endoscopy, it can spread rapidly throughout the whole body after intravenous infusion and make the human body in sleep state, the recovery is quick after the drug is stopped, but the analgesic effect of the drug is weak and large-dose application can exert inhibitory effect on the respiratory system and circulatory system, so propofol intravenous anesthesia alone for painless gastrointestinal endoscopy has been controversial, especially for the elderly population[3,4]. Etomidate is a kind of hypnotic general anaesthetic, which has a mild effect on the cardiovascular system at regular doses, has central sedative and amnesia effect and is considered to be a reliable adjuvant anaesthetic[5,6]. In this research, etomidate combined with propofol was used for the anesthesia of subjects with painless gastrointestinal endoscopy in our hospital between December 2015 and January 2017, and the influence on the stress reaction, inflammatory response and so on in the subjects during examination was explored in order to clarify the reliability and feasibility of the anesthetic scheme.

2. Information and methods

2.1 General information

A total of 380 subjects who received painless gastrointestinal endoscopy were divided into control group (n=190) and observation group...
2.2 Inclusion and exclusion criteria

Inclusion criteria: (1) without history of painless gastrointestinal endoscopy or general anesthesia within half a year prior to inclusion; (2) not combined with basic systemic inflammatory response; (3) not combined with pheochromocytoma and other diseases that caused the patients to be in a basic stress state; (4) cooperating with anesthesia and related examinations throughout the whole process. Exclusion criteria: (1) allergic to etomidate and/or propofol; (2) combined with severe heart, liver and kidney insufficiency.

2.3 Anesthesia methods

Control group underwent propofol intravenous anesthesia, specifically as follows: establishing peripheral vascular venous access after they entered the room, connecting ECG monitoring and blood oxygen saturation meter, slow intravenous propofol (Sichuan Guorui Pharmaceutical Co., Ltd., approved by H20040079) 1.5 mg/kg, starting painless gastrointestinal endoscopy after eyelash reflexes disappeared, target controlled infusion of propofol 4-5 mg/(k·h) during examination, and stopping propofol infusion 1 min before the examination was completed. During the inspection, the operation should be stopped in time to take the corresponding treatment if the heart rate was 55 times/min, and the blood oxygen saturation was 90%. After the inspection was completed, the subjects were sent to postoperative observation room and could leave 1 h after being conscious.

Observation group underwent etomidate combined with propofol intravenous anesthesia, specifically as follows: slow infusion of etomidate (Jiangsu Nhwa Pharmaceutical Co., Ltd, approved by H32022992) 0.15 mg/kg, slow infusion of 0.5-1.0 mg/kg etomidate after the eyelash reflexes disappeared, target-controlled infusion of propofol 4-5 mg/(k·h) for maintenance, and same subsequent processing method as that of control group.

2.4 Observation indexes

24 h before examination, during examination and 1 h after examination, 2.0 mL of fasting cubital venous blood was collected respectively, anti-coagulated with low molecular heparin (Shenzhen Sciprogen Bio-pharmaceutical Co., Ltd., approved by H20052319) and then centrifuged at 3 000-5 000 r/min for 10-15 min to get the upper serum and cryopreserve it for test. ELISA kit instructions were followed to determine the serum contents of stress indexes, including norepinephrine (NE), epinephrine (E), cortisol (Cor), aldosterone (ALD) and angiotensin II (AT-II) as well as the serum contents of inflammatory factors, including interleukin-1β (IL-1β), interleukin-4 (IL-4), interleukin-6 (IL-6), interleukin-8 (IL-8), interleukin-10 (IL-10), and tumor necrosis factor α (TNF-α). The ELISA kits were purchased from the American Gibical Company, and the article number was KS-981, HSG-47, LD-355, BAG-136, LDK-092, YSA716, MD-017, IS-376, FR-102, KSJ197 and LDK-492 respectively.

2.5 Statistical processing

Statistical software was SPSS 26.0. Stress indexes and inflammatory factors were in terms of mean ± standard deviation and input in the software, then t test was used to calculate the statistics. P < 0.05 indicated statistical significance in differences.

3. Results

3.1 Stress indexes

Comparison of stress indexes NE (ng/mL), E (ng/mL), Cor (nmol/L), ALD (pg/mL) and AT-II (ng/mL) contents between two groups of research subjects at different points in time was as follows: 24 h before examination, difference in serum NE, Cor, ALD and AT-II contents were not statistically significant between the two groups of subjects (P > 0.05). During examination and 1 h after examination, serum NE, E, Cor, ALD and AT-II contents of both groups were higher than those 24 h before examination, and serum NE, E, Cor, ALD and AT-II contents of observation group were lower than those of control group (P < 0.05), shown in Table 1.

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>Time</th>
<th>NE</th>
<th>E</th>
<th>Cor</th>
<th>ALD</th>
<th>AT-II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>190</td>
<td>24 h before examination</td>
<td>51.28±6.09</td>
<td>43.21±5.63</td>
<td>183.29±21.42</td>
<td>30.18±4.52</td>
<td>19.26±2.17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>During examination</td>
<td>93.27±10.35</td>
<td>78.49±8.34</td>
<td>452.46±59.83</td>
<td>67.26±8.94</td>
<td>37.49±4.51</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 h after examination</td>
<td>73.27±8.45*</td>
<td>59.34±6.32</td>
<td>273.46±35.81*</td>
<td>50.35±5.83*</td>
<td>30.74±4.21*</td>
</tr>
<tr>
<td>Observation group</td>
<td>190</td>
<td>24 h before examination</td>
<td>50.95±5.23</td>
<td>42.94±5.37</td>
<td>182.64±22.49</td>
<td>30.64±4.39</td>
<td>19.53±2.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>During examination</td>
<td>76.23±8.59*</td>
<td>62.15±7.53ab</td>
<td>302.47±39.57ab</td>
<td>50.42±6.32ab</td>
<td>29.36±3.51ab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 h after examination</td>
<td>61.23±7.53*</td>
<td>51.25±6.02ab</td>
<td>227.48±25.63ab</td>
<td>39.81±5.43*</td>
<td>23.46±3.05ab</td>
</tr>
</tbody>
</table>

Note: compared with same group 24 h before examination, *P < 0.05; compared with control group during examination, †P < 0.05; compared with control group 1 h after examination, ‡P < 0.05.
Note: compared with same group 24h before examination, insufficient sedation and analgesia function of propofol respiratory the subjects during examination, which are directly related to the respiratory depression and other adverse reactions may occur in time, but many cases show that drastic hemodynamic fluctuation, gastrointestinal endoscopy has been controversial, propofol The selection of intravenous anesthesia drugs for painless gastrointestinal endoscopy at present. Etomidate is a short-acting intravenous anesthetic, which takes effect and is metabolized quickly, has no obvious respiratory inhibition and causes small effect on the cardiovascular system, and helps to reduce the myocardial oxygen consumption and stabilize circulation[10-12]. In the research, propofol anesthesia alone and etomidate combined with propofol anesthesia were used for painless gastrointestinal endoscopy respectively in order to clarify the more appropriate intravenous anesthesia scheme and ensure subjects’ life safety to the greatest extent.

### 3.2 Inflammatory factors

Comparison of inflammatory factors IL-1β, IL-4, IL-6, IL-8, IL-10 and TNF-α contents between two groups of research subjects at different points in time was as follows: 24 h before examination, difference in serum IL-1β, IL-4, IL-6, IL-8, IL-10 and TNF-α contents were not statistically significant between the two groups of subjects (P>0.05). During examination and 1 h after examination, serum IL-1β, IL-4, IL-6, IL-8, IL-10 and TNF-α contents of both groups were higher than those 24 h before examination, and serum IL-1β, IL-4, IL-6, IL-8, IL-10 and TNF-α contents of observation group were lower than those of control group (P<0.05), shown in Table 2.

### 4. Discussion

The selection of intravenous anesthesia drugs for painless gastrointestinal endoscopy has been controversial, propofol intravenous anesthesia alone has been clinically applied for a long time, but many cases show that drastic hemodynamic fluctuation, respiratory depression and other adverse reactions may occur in the subjects during examination, which are directly related to the insufficient sedation and analgesia function of propofol, respiratory depression after large-dosage application and other mechanisms[7-9]. How to reduce the dosage of propofol (reduce the adverse reactions caused by it) but ensure enough anesthesia depth is the key of the clinical study, and many scholars have recommended etomidate combined with propofol anesthesia for painless gastrointestinal endoscopy at present. Etomidate is a short-acting intravenous anesthetic, which takes effect and is metabolized quickly, has no obvious respiratory inhibition and causes small effect on the cardiovascular system, and helps to reduce the myocardial oxygen consumption and stabilize circulation[10-12]. In the research, propofol anesthesia alone and etomidate combined with propofol anesthesia were used for painless gastrointestinal endoscopy respectively in order to clarify the more appropriate intravenous anesthesia scheme and ensure subjects’ life safety to the greatest extent.

Insufficient sedation and analgesia as well as gastrointestinal endoscopy operation stimulation to the body can directly cause stress reaction in the body, a lot of stress hormones are secreted and promote the heart rate to rise and the blood pressure to elevate, and severe cases can cause cardiovascular and cerebrovascular events[13,14]. The degree of stress response in the body can objectively reflect the sedation and analgesia perfection of intravenous analgesia, which can be specifically expressed by serum stress hormone contents. NE, E, Cor and ALD belong to adrenal medulla and adrenal cortex hormones, and endoscopic stimulation to gastrointestinal wall during gastrointestinal endoscopy can directly stimulate the central sensors and promote their secretion[15]. The AT-II is the stress hormone secreted by RAAS, it can strongly shrink blood vessels and increase blood pressure, and its content is highly consistent with the body's stress level[16]. It was found in the study that compared with those 24 h before examination, serum NE, E, Cor, ALD and AT-II contents of both groups were higher during examination and 1 h after examination, indicating that the stimulation caused by gastrointestinal endoscopy can directly cause stress reaction in client; further compared with those of control group, serum NE, E, Cor, ALD and AT-II contents of observation group were lower during examination and 1 h after examination, indicating that the gastrointestinal endoscopy under etomidate combined with propofol intravenous anesthesia causes weaker stress reaction, and in other words, combined intravenous anesthesia can effectively reduce the stress level in the process of painless gastrointestinal endoscopy. The stimuli caused by endoscopic operation, hemodynamic fluctuations of client and so on are all direct causes of increased inflammatory factor secretion and micro-inflammatory state generation, excessive inflammatory response can cause cardiovascular endothelial injury, and the probability of cardiovascular events rises during examination and early after examination[17,18]. IL-1β, IL-6, IL-8 and TNF-α are pro-inflammatory factors that can induce neutrophils to accumulate and exacerbate inflammatory responses[19,20]. IL-4 and IL-10 have anti-inflammatory effects, their secretion increases after inflammation and inhibits the progress of systemic inflammatory response, and their

### Table 2.

Comparison of serum inflammatory factor contents at different points in time (pg/mL).

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>Time</th>
<th>IL-1β</th>
<th>IL-4</th>
<th>IL-6</th>
<th>IL-8</th>
<th>IL-10</th>
<th>TNF-α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>190</td>
<td>24 h before examination</td>
<td>3.04±0.35</td>
<td>1.39±0.18</td>
<td>5.48±0.61</td>
<td>10.18±1.73</td>
<td>6.21±0.75</td>
<td>4.12±0.49</td>
</tr>
<tr>
<td></td>
<td></td>
<td>During examination</td>
<td>7.19±0.84</td>
<td>3.62±0.49</td>
<td>9.27±0.91</td>
<td>25.47±3.85</td>
<td>12.04±1.75</td>
<td>7.21±0.85</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 h after examination</td>
<td>5.11±0.54</td>
<td>2.73±0.31</td>
<td>7.03±0.75</td>
<td>17.05±2.13</td>
<td>9.43±1.18</td>
<td>6.04±0.63</td>
</tr>
<tr>
<td>Observation</td>
<td>190</td>
<td>24 h before examination</td>
<td>3.06±0.32</td>
<td>1.41±0.15</td>
<td>5.46±0.59</td>
<td>10.09±1.68</td>
<td>6.19±0.78</td>
<td>4.09±0.47</td>
</tr>
<tr>
<td></td>
<td></td>
<td>During examination</td>
<td>5.84±0.63</td>
<td>2.76±0.36</td>
<td>8.13±0.85</td>
<td>17.23±2.11</td>
<td>10.12±1.64</td>
<td>5.42±0.58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 h after examination</td>
<td>4.28±0.57</td>
<td>2.16±0.25</td>
<td>6.12±0.65</td>
<td>13.42±1.78</td>
<td>7.43±0.86</td>
<td>4.87±0.51</td>
</tr>
</tbody>
</table>

Note: compared with same group 24h before examination, *P<0.05; compared with control group during examination, *P<0.05; compared with control group 1h after examination, *P<0.05.
It was found in the study that compared with those 24 h examination, serum IL-1β, IL-4, IL-6, IL-8, IL-10 and TNF-α contents of both groups were higher during examination and 1 h after examination, indicating that the stimulation caused by gastrointestinal endoscopy can directly cause inflammation response in client; further compared with those of control group, serum IL-1β, IL-4, IL-6, IL-8, IL-10 and TNF-α contents of observation group were lower during examination and 1 h after examination, indicating that the gastrointestinal endoscopy under etomidate combined with propofol intravenous anesthesia causes weaker inflammatory reaction, and in other words, combined intravenous anesthesia can effectively reduce the inflammation level in the process of painless gastrointestinal endoscopy.

Thus, it is concluded that compared with propofol intravenous anesthesia alone, etomidate combined with propofol anesthesia for painless gastrointestinal endoscopy can more effectively reduce the body's stress response and inflammation during examination and early after examination, helps to maintain homeostasis in the client and improve examination safety, and is worthy of popularization and application in clinical practice in the future.

References


