Effect of epidural anesthesia combined with total intravenous anesthesia on stress response and coagulation function in and after laparoscopic surgery

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Objective: To study the effect of epidural anesthesia combined with total intravenous anesthesia on stress response and coagulation function in and after laparoscopic surgery.

Methods: A total of 219 cases of patients who underwent laparoscopic cholecystectomy in our hospital between August 2014 and February 2017 were collected and divided into control group (n=125) who accepted total intravenous anesthesia alone and observation group (n=94) who accepted epidural anesthesia combined with total intravenous anesthesia after the anesthesia scheme was reviewed. Perioperative stress response and coagulation function were compared between two groups of patients.

Results: Before operation, differences in the serum stress index contents and peripheral blood coagulation index levels were not statistically significant between two groups of patients. In operation and 2 h after operation, serum stress indexes Cor, Ang-I, Ang-II and NE contents of observation group were significantly lower than those of control group; peripheral blood coagulation indexes PT, TT and APTT levels were significantly higher than those of control group while TXA2, TXB2 and FBG levels were significantly lower than those of control group.

Conclusions: Epidural anesthesia combined with total intravenous anesthesia can effectively alleviate the systemic stress response and reduce the hypercoagulable state in and early after laparoscopic surgery.

1. Introduction

Laparoscopy is the most common way of clinical minimally invasive surgery, but intraoperative operation, laparoscopic incision in abdominal cavity and so on can still cause certain trauma to patients, and cause intraoperative and postoperative stress reaction, and even cause a series of complications for the severe patients, hindering the realization of the surgery effect[1,2]. The depth of anesthesia and the completeness of analgesia largely determine the degree of intraoperative and postoperative traumatic stress in surgical patients, so the choice of specific anesthesia has a great effect on the outcome of the operation. Total intravenous anesthesia is the most common way of anesthesia, it can meet the anesthesia required for basic surgery, but many cases at present have shown that the incidence of postoperative agitation is high in patients with laparoscopic surgery under total intravenous anesthesia alone, which may be related to the incompleteness of intraoperative analgesia[3-4]. Epidural anesthesia is the anaesthesia to block the spinal nerve root, which has better analgesic effect and can be used for any operation other than that of the head[5]. In this research, epidural anesthesia and total intravenous anesthesia were used together for patients with clinical laparoscopic cholecystectomy, and the application value was discussed from two aspects of stress reaction and blood coagulation function, now reported as follows.

2. Materials and methods

2.1 Case information

A total of 219 cases of patients who underwent laparoscopic cholecystectomy in Xi’an Hospital of Traditional Chinese Medicine between August 2014 and February 2017 were selected as the research subjects, and the patients themselves and their families signed the informed consent. After the anesthesia scheme was reviewed, the enrolled patients were divided into control group (n=125) who accepted total intravenous anesthesia alone and
observation group (n=94) who accepted epidural anesthesia combined with total intravenous anesthesia. Control group included 65 male cases and 60 female cases that were 23-75 years old, while observation group included 50 male cases and 44 female cases that were 25-78 years old. The gender and age distribution of the two groups were not statistically different (P>0.05), and the study was approved by the ethics committee of the hospital.

Inclusion criteria: (1) without history of laparoscopic surgery before; (2) without general anesthesia history within 1 year before surgery; (3) without severe complications during anesthesia and operation. Exclusion criteria: (1) associated with contraindications of epidural anesthesia; (2) combined with systemic infectious diseases; (3) combined with preoperative basic coagulation dysfunction; (4) combined with malignant tumor disease.

2.2. Anesthesia method

The control group of patients received total intravenous anesthesia alone, specifically as follows: 5 mg of midazolam (produced by Yichang Humanwell Pharmaceutical Co., Ltd., Approval No. H20067040), 0.1 μg/kg of fentanyl (produced by Jiangsu Nhwa Pharmaceutical Co., Ltd, Approval No. H20113507) and 0.15 mg/kg of cis atracurium (produced by Jiangsu Hengrui Medicine Co., Ltd., Approval No. H20061065) were put in tracheal catheter, the ventilator was connected to control breathing, the tidal volume was set to 10 mL/kg and respiratory frequency to 12 times/min, anesthesia maintenance was by 3-5 mg/(kg·h) of propofol (produced by Guangdong Jiabo Pharmaceutical Co., Ltd., Approval No. H20051843) and 0.7 μg/(kg·h) of remifentanil (produced by Guangxi Nanning Baihui Pharmaceutical Co., Ltd., Approval No. H20067040), 0.1 μg/kg of fentanyl (produced by Jiangsu Nhwa Pharmaceutical Co., Ltd, Approval No. H20051843) and 0.7 μg/(kg·h) of remifentanil (produced by Guangdong Jiabo Pharmaceutical Co., Ltd., Approval No. H20051843) and 0.15 mg/kg of cis atracurium (produced by Jiangsu Hengrui Medicine Co., Ltd., Approval No. H20061065) was injected, a total of 2% lidocaine (produced by Guangxi Nanning Baihui Pharmaceutical Co., Ltd., Approval No. H20061065) was injected after 5 min, and the plane was adjusted to T8. After 1 h, 5 mL of 2% lidocaine + 0.5% ropivacaine (produced by Chenxin Group Co., Ltd, Approval No.H45020569) was injected, a total of 10 mL of 1% lidocaine + 0.5% ropivacaine (produced by Chenxin Pharmaceutical Co., Ltd., Approval No. H20061065) was injected after 5 min, and the plane was adjusted to T8. After 1 h, 5 mL of 2% lidocaine was injected every 30 min. Intravenous anesthesia method was the same as that of control group.

The observation group of patients accepted epidural anesthesia combined with total intravenous anesthesia, specifically as follows: puncture cathetering was via the L1-2 clearance, test dose 3 mL of 2% lidocaine (produced by Guangxi Nanning Baihui Pharmaceutical Group Co., Ltd., Approval No.H45020569) was injected, a total of 10 mL of 1% lidocaine + 0.5% ropivacaine (produced by Chenxin Pharmaceutical Co., Ltd., Approval No. H20061065) was injected after 5 min, and the plane was adjusted to T8. After 1 h, 5 mL of 2% lidocaine was injected every 30 min. Intravenous anesthesia method was the same as that of control group.

2.3. Stress response

Before, during and 2 h after operation, 2-3 mL of fasting cubital venous blood was extracted from two groups of patients respectively, anti-coagulated with sodium citrate and then centrifuged at 2500-3 500 r/min for 10-15 min, the upper serum was collected, and enzyme-linked immunosorbent assay was used to detect the levels of stress hormones, including cortisol (Cor), angiotensin I (Ang-Ⅰ), angiotensin II (Ang-Ⅱ) and norepinephrine (NE).

2.4. Coagulation function

Before, during and 2 h after operation, fasting cubital venous blood was obtained from two groups of patients in the same way, and coagulation analyzer (Trinity Biotech Plc, specifications Destiny Max) was used to detect the levels of coagulation function indexes, including the prothrombin time (PT), thrombin time (TT), activated partial prothrombin time (APTT), thromboxane A2 (TXA2), thromboxane B2 (TXB2) and fibrinogen (FBG).

2.5. Statistical methods

The statisticians received professional training, and the statistical software was SPSS 20.0. Stress indicators, coagulation indexes and other measurement data were in terms of mean ± standard deviation, and comparison was by t test. Statistics P<0.05 was the standard of statistical significance in differences.

3. Results

3.1. Stress indexes

Comparison of perioperative serum stress indexes Cor (μg/mL), Ang-Ⅰ (ng/mL), Ang-Ⅱ (ng/mL) and NE (ng/mL) contents between two groups of patients was as follows: before operation, differences in serum Cor, Ang-Ⅰ, Ang-Ⅱ and NE contents were not statistically significant between two groups of patients (P>0.05). In operation and 2 h after operation, serum Cor, Ang-Ⅰ, Ang-Ⅱ and NE contents of both groups were higher than those before operation.
Comparison of perioperative coagulation indexes PT, TT and APTT levels between two groups of patients.

### Table 3.

Comparison of perioperative coagulation indexes TXA2, TXB2 and FBG levels between two groups of patients.

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>Before operation</th>
<th>After operation</th>
<th>Before operation</th>
<th>After operation</th>
<th>Before operation</th>
<th>After operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>125</td>
<td>34.28±4.11</td>
<td>52.28±6.12</td>
<td>63.47±8.04</td>
<td>20.38±2.74</td>
<td>34.17±4.52</td>
<td>55.82±7.19</td>
</tr>
<tr>
<td>Observation group</td>
<td>94</td>
<td>34.17±4.09</td>
<td>41.63±4.88</td>
<td>49.62±5.05</td>
<td>20.67±2.85</td>
<td>25.88±5.04</td>
<td>34.61±4.05</td>
</tr>
</tbody>
</table>

Note: Compared with same group before operation, \( P < 0.05 \).

Comparison of perioperative peripheral blood coagulation indexes PT, TT and APTT levels between two groups of patients.

### Table 4.

Comparison of perioperative coagulation indexes TXA2, TXB2 and FBG levels between two groups of patients.

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>Before operation</th>
<th>After operation</th>
<th>Before operation</th>
<th>After operation</th>
<th>Before operation</th>
<th>After operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>125</td>
<td>45.38±5.12</td>
<td>54.21±6.09</td>
<td>73.28±9.17</td>
<td>102.18±14.38</td>
<td>119.36±14.52</td>
<td>145.77±18.93</td>
</tr>
<tr>
<td>Observation group</td>
<td>94</td>
<td>45.29±5.31</td>
<td>48.76±5.42</td>
<td>58.21±7.43</td>
<td>104.27±13.94</td>
<td>109.64±13.21</td>
<td>121.64±14.28</td>
</tr>
</tbody>
</table>

Note: Compared with same group before operation, \( P > 0.05 \).

### 3.2. Coagulation indexes

Comparison of perioperative peripheral blood coagulation indexes PT (s), TT (s), APTT (s), TXA2 (pg/mL), TXB2 (pg/mL) and FBG (g/L) levels between two groups of patients was as follows: before operation, differences in peripheral blood PT, TT, APTT, TXA2, TXB2 and FBG levels were not statistically significant between two groups of patients \( (P > 0.05) \). In operation and 2 h after operation, peripheral blood PT, TT and APTT levels of both groups were lower than those before operation while TXA2, TXB2 and FBG levels were higher than those before operation, peripheral blood PT, TT and APTT levels of observation group were higher than those of control group while TXA2, TXB2 and FBG levels were lower than those of control group, and differences were statistically significant \( (P < 0.05) \), shown in Table 3 and Table 4.

### 4. Discussion

Total intravenous anesthesia is a common anesthesia for clinical laparoscopic surgery, but total intravenous anesthesia alone cannot effectively prevent the sympathetic - adrenal medulla system, and intraoperative stimulus, wound pain and so on will cause stress response, which is not conducive to postoperative wound healing, and can even lead to stress ulcer, bleeding and other serious complications\[6-7\]. Reasonable choice of anesthesia methods is of great significance for the realization of the expected curative effect in patients with laparoscopic surgery, and in order to stabilize the patient's hemodynamics and reduce the adverse reactions caused by perioperative stress, many scholars have currently recommended epidural anesthesia on the basis of total intravenous anesthesia.

Epidural anesthesia directly blocks spinal nerve conduction by spinal canal, inhibits nerve impulse conduction of sympathetic-adrenal medulla system, and helps to suppress all kinds of stress reactions caused by the sympathetic nerve excitement\[8-10\]. In the study, epidural anesthesia combined with total intravenous anesthesia was applied in the observation group of patients, the differences in stress index contents were compared between two groups of patients at first, and it was found that serum Cor, Ang- I , Ang- II and NE contents of both groups in operation and 2 h after operation were higher than those before operation, indicating that there are still different degrees of systemic stress reaction after anesthesia; further compared with control group in operation and 2 h after operation, observation group were with lower serum Cor, Ang- I , Ang- II and NE contents at the same points in time, proving that adding epidural anesthesia can effectively block intraoperative and early postoperative stress response. Epidural local application of local anesthetics can directly block the body’s sympathetic activity,
and inhibit the ascending transduction of nociceptive stimulus as well as the resulting hemodynamic fluctuations and massive stress hormone release, which is the direct cause of lower intraoperative and early postoperative stress hormone contents in circulating blood of observation group of patients.

Laparoscopic surgery belongs to the minimally invasive surgery, but intraoperative pneumoperitoneum establishment and surgical operation can both cause different degree of trauma to the body, which can lead to the increased platelet aggregation and hypercoagulable state, as well as the multiplying risk of postoperative thrombotic complications[11,12]. The blood coagulation function in patients with laparoscopic surgery is closely related to surgical trauma, and the levels of blood coagulation-related indexes can indirectly reflect the trauma extent. PT, TT and APTT are the most common clotting time indicators. When hypercoagulable state occurs and blood coagulation is enhanced, PT, TT and APTT are shortened[13,14]. TXA2 and TXB2 are important substances that regulate platelet aggregation, which can activate platelets, promote platelet aggregation, accelerate microthrombosis, etc.[15,16]. FBG is a protein with coagulation function that is synthesized by liver, which can promote platelet aggregation, and increase blood viscosity and peripheral resistance. In the study, peripheral blood coagulation function index levels were compared between two groups of patients, and it was found that compared with those before operation, peripheral blood PT, TT and APTT levels of both groups in operation and 2 h after operation were shortened while TXA2, TXB2 and FBG levels were increased, indicating that laparoscopic surgeries under different anesthesia can both lead to different degrees of hypercoagulable state; further compared with control group in operation and 2 h after operation, the observation group of patients were with higher peripheral blood PT, TT and APTT levels, and low TXA2, TXB2 and FBG levels the same points in time, confirming that epidural anesthesia combined with total intravenous anesthesia can effectively inhibit the occurrence of excessive hypercoagulable state, and this is one of the important performances for it to reduce intraoperative trauma.

Epidural anesthesia combined with total intravenous anesthesia for patients with laparoscopic surgery helps ease intraoperative and early postoperative systemic stress, and optimize blood coagulation function It is a more reasonable way of anesthesia, and is worthy of popularization and application in clinical practice in the future.

References


