Effects of Transversus Abdominis Plane Block and Patient Controlled Intravenous Analgesia on Cognitive Function and Early Recovery in Elderly Patients Undergoing Laparoscopic Surgery

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Abstract

Objective: To study and analyze the effects of transversus abdominis plane block (TAPB) and patient controlled intravenous analgesia (PCIA) on cognitive function and early rehabilitation in elderly patients undergoing laparoscopic surgery. Methods: 100 elderly patients undergoing elective laparoscopic surgery in our hospital from October 2020 to May 2023 were selected and divided into study group and control group by random number table method, with 50 cases in each group. Patients in both groups were given general anesthesia during the operation, patients in the control group received PCIA intervention, and patients in the study group received postoperative transversal muscle plane block combined with controlled intravenous analgesia. Postoperative pain and agitation, perioperative cognitive function at different stages, and early postoperative rehabilitation were evaluated and compared between the two groups. Results: VAS scores in the study group were lower than those in the control group at 12h and 36h after surgery, and the incidence of agitation was lower than that in the control group, with statistical differences (P < 0.05). There was no statistical difference in MMSE scores between the two groups 24 hours before surgery (P < 0.05), and the MMSE scores in the study group were higher than those in the control group 24 hours and 72 hours after surgery, with statistical significance (P < 0.05). The time of first feeding, leaving bed, exhaust gas, defecation and perioperative hospital stay in the study group were shorter than those in the control group, and the differences were statistically significant (P < 0.05). Conclusion: The combined application of TAPB and PCIA in elderly patients undergoing laparoscopic surgery can enhance the postoperative analgesia effect, reduce the incidence of agitation, improve early postoperative cognitive function, and promote early rehabilitation.

Keywords

Transversus abdominis plane block, Patient controlled intravenous analgesia, elderly patients, Laparoscopic surgery, Cognitive function, Early rehabilitation

Laparoscopy is a minimally invasive technique widely used in medical institutions, which has gradually replaced traditional open surgery or small-incision surgery in the treatment of some diseases and has become the “gold stan-
dard” of surgical treatment [1]. Laparoscopic surgery in the elderly is a common operation for the treatment of gallbladder diseases and gastrointestinal diseases in the elderly, with advantages such as less trauma and good early prognosis [2-3]. At present, laparoscopic technology has become more mature, and its value in injury control is beyond doubt compared with traditional surgery. However, laparoscopic surgery can still cause certain trauma and induce stress reaction and even pathological stress. Under the influence of an individual’s overall state (such as age, underlying diseases, inflammation, etc.), the occurrence of perioperative stress reaction will increase the risk of stress diseases and perioperative complications [4], which will affect the quality and effect of surgery and hinder early postoperative rehabilitation. At the same time, clinical studies [5-6] have found that elderly patients undergoing surgery are affected by factors such as their own physiological conditions and surgical operations, and early postoperative cognitive function impairment is more common, which is also one of the main reasons hindering early postoperative rehabilitation. Effective control of early postoperative pain response and reduction of the risk of cognitive function impairment is the key to ensuring the surgical effect and promoting early rehabilitation, which is often supported by effective postoperative analgesia in the field of anesthesia. Self-controlled intravenous analgesia is the most commonly used method in postoperative analgesia, and patients can exert better analgesia effect by self-pumping anesthetic liquid as needed. TAPB is a relatively new regional block anesthesia technique, which blocks the anterior nerve endings of the abdominal wall and can effectively relieve postoperative pain [7-8]. In order to further clarify the application effect of TAPB and patient controlled intravenous analgesia (PCIA) in elderly patients, this study included some elderly patients undergoing laparoscopic surgery for exploration, as follows.

1. Data and methods

1.1 General information

100 elderly patients with elective laparoscopic surgery admitted to our hospital from October 2020 to May 2023 were selected and divided into study group and control group by random number table method, with 50 cases in each group. There was no statistical difference in the comparison of general data between the two groups (P > 0.05), as shown in Table 1. Inclusion criteria: (1) confirmed benign lesions; (2) Patients who meet the indications of laparoscopic surgery; (3) Patients undergoing elective surgery; (4) no history of abdominal or pelvic surgery; (5) Patients who had not received immunosuppressive, hormone or drug intervention affecting gastrointestinal motility within 6 months before enrollment; (6) Mental, psychological and cognitive conditions are normal. Exclusion criteria: (1) cardiopulmonary function cannot tolerate anesthesia or surgery; (2) Conversion to laparotomy; (3) Patients with acute pancreatitis, obstructive jaundice and other serious complications; (4) Patients with abnormal functions of important organs; (5) Diagnosis of malignant lesions, such as breast cancer, stomach cancer, etc.; (6) People with coagulation disorders; (7) Patients with infectious diseases, such as influenza, hepatitis B, etc.

<table>
<thead>
<tr>
<th>Group</th>
<th>Gender</th>
<th>Age</th>
<th>Operation time</th>
<th>Underlying disease</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Male/Female, case)</td>
<td>(¯x ± s, age)</td>
<td>(¯x ± s, min)</td>
<td>(Diabetes/hypertension/other, case)</td>
</tr>
<tr>
<td>Research group/50</td>
<td>28/22</td>
<td>69.58±6.41</td>
<td>60.23±15.49</td>
<td>7/5/3</td>
</tr>
<tr>
<td>Control group/50</td>
<td>26/24</td>
<td>68.71±6.73</td>
<td>59.41±16.03</td>
<td>6/6/3</td>
</tr>
<tr>
<td>χ²/t</td>
<td>0.161</td>
<td>0.662</td>
<td>0.260</td>
<td>0.168</td>
</tr>
<tr>
<td>P</td>
<td>0.688</td>
<td>0.510</td>
<td>0.795</td>
<td>0.983</td>
</tr>
</tbody>
</table>

1.2 Method

Patients in both groups were given general anesthesia during the operation. Patients in the control group underwent PCIA intervention, while patients in the study group underwent TAPB combined with controlled intravenous analgesia. The specific anesthesia program is as follows.

1.2.1 Control group

Controlled intravenous analgesia was carried out, general anesthesia drug administration was stopped, and postoperative monitoring was carried out until the patients recovered. After surgery, intravenous controlled analgesia intervention was used, with the anesthetic solution of 100ug sufentanil and 16mg Ondansetron mixed with 100ml normal saline, the controlled amount was 2ml/ time, locked for 5 minutes, and the number of controlled analgesia per hour was controlled within 8 or less.
1.2.2 Study group

Transversal plane block combined with controlled intravenous analgesia was performed. After surgery, transver-
sal plane puncture was performed under ultrasound guidance before general anesthesia. The body position was ad-
justed to the supine position, routine disinfection was performed, and the probe was placed on the 12 ribs and the
medial axillary line of the abdominal wall between the iliac ridge for moving adjustment, and the internal and ex-
ternal oblique muscles and transverse muscles of the abdomen were observed and positioned. After the positioning
was completed, the needle was inserted, and the Angle between the longitudinal axis plane was controlled at about
45°. The depth of the needle was inserted until there was no abnormality between the transverse abdominal muscle
and the internal oblique abdominal muscle. After the withdrawal, 2ml normal saline was injected to separate the
fascia layer. The anesthetic solution was 0.5 μg/kg dexmedetomidine and 0.375% ropivacaine, and 20ml was in-
jected into each side. After the above procedures are completed, the administration of general anesthesia drugs is
stopped and postoperative monitoring is performed until the patient recovers. After surgery, intravenous controlled
analgesia intervention was used, with the anesthetic solution of 100ug sufentanil and 16mg Ondansetron mixed
with 100ml normal saline, the controlled amount was 2 ml/ time, locked for 5 minutes, and the number of con-
trolled analgesia per hour was controlled within 8 or less.

1.3 Observation index

1.3.1 Evaluation of postoperative pain and agitation

At 12h and 36h after surgery, visual analogue scale (VAS) was used to evaluate the postoperative pain of patients,
with a total of 10 points. The lower the score is, the more outstanding the pain control effect is. Agitation was
assessed by the agitation score, with a total of 0 to 3, 0 without agitation, 1 with mild agitation or no intermittent
moaning, 2 with moderate agitation and persistent moaning, and 3 with severe agitation requiring protective re-
straint.

1.3.2 Cognitive function assessment

At the three stages of preoperative 24h, postoperative 24h and postoperative 72h, the mini-mental state examina-
tion (MMSE) was performed with a total score of 0~30 points. ≥27 was classified as normal, ≤26 as cognitive im-
pairment, 21-26 as mild, and 10-20 as moderate. Otherwise, it is severe.

1.3.3 Assessment of early recovery

The first postoperative feeding, leaving bed, exhaust, defecation time and perioperative hospital stay of the two
groups were statistically analyzed.

1.4 Statistical methods

SPSS23.0 statistical software was used for processing, measurement data were expressed as ( \( \bar{x} \pm s \) ), comparison
was performed by t test, count data were expressed as percentage, comparison was performed by \( \chi^2 \) test, \( P < 0.05 \)
was considered statistically significant.

2. Result

2.1 Comparison of postoperative pain and agitation between the two groups

VAS scores at 12h and 36h after surgery in the study group were lower than those in the control group, and the
incidence of agitation was lower than that in the control group, with statistical differences ( \( P < 0.05 \) ), as shown in
Table 2.

<table>
<thead>
<tr>
<th>Group</th>
<th>Postoperative pain ( ( \bar{x} \pm s ), points)</th>
<th>Postoperative agitation (case %)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12h after surgery</td>
<td>36h after surgery</td>
</tr>
<tr>
<td>Research group/50</td>
<td>2.20±0.54</td>
<td>2.11±0.59</td>
</tr>
<tr>
<td>Control group/50</td>
<td>3.37±0.70</td>
<td>3.16±0.72</td>
</tr>
<tr>
<td>( \chi^2/t )</td>
<td>9.358</td>
<td>7.976</td>
</tr>
<tr>
<td>P</td>
<td>&lt; 0.001</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

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2.2 Comparison of cognitive function in different stages of perioperative period between the two groups

There was no statistical difference in MMSE scores between the two groups 24 hours before surgery (P < 0.05), and MMSE scores in the two stages 24 hours and 72 hours after surgery were higher than those in the control group, with statistical significance (P < 0.05), as shown in Table 3.

Table 3. Comparison of cognitive function in different stages of perioperative period between the two groups (x ± s)

<table>
<thead>
<tr>
<th>Group</th>
<th>24h before surgery (points)</th>
<th>24h after surgery (points)</th>
<th>72h after surgery (points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research group/50</td>
<td>27.32±1.98</td>
<td>24.14±2.31</td>
<td>25.74±1.94</td>
</tr>
<tr>
<td>Control group/50</td>
<td>27.45±1.87</td>
<td>22.49±1.85</td>
<td>23.51±1.70</td>
</tr>
<tr>
<td>t</td>
<td>0.338</td>
<td>3.942</td>
<td>6.113</td>
</tr>
<tr>
<td>P</td>
<td>0.736</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

2.3 Comparison of early postoperative recovery between the two groups

Patients in the study group were shorter than those in the control group in terms of first postoperative eating, leaving bed, exhaust, defecation time and perioperative hospital stay, with statistical significance (P < 0.05), as shown in Table 4.

Table 4. Comparison of early postoperative recovery between the two groups (x ± s)

<table>
<thead>
<tr>
<th>Group</th>
<th>Time of first feeding after surgery (h)</th>
<th>First time out of bed after surgery (h)</th>
<th>First postoperative exhaust time (h)</th>
<th>Time of first postoperative defecation (h)</th>
<th>Perioperative hospital stay (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research group/50</td>
<td>13.41±3.43</td>
<td>18.31±4.12</td>
<td>17.11±3.77</td>
<td>28.59±3.41</td>
<td>5.49±1.24</td>
</tr>
<tr>
<td>Control group/50</td>
<td>18.74±3.92</td>
<td>25.68±5.03</td>
<td>23.05±4.53</td>
<td>36.50±5.38</td>
<td>7.23±1.09</td>
</tr>
<tr>
<td>t</td>
<td>7.236</td>
<td>8.015</td>
<td>7.127</td>
<td>8.781</td>
<td>7.452</td>
</tr>
<tr>
<td>P</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

3. Discussion

Laparoscopic surgery is a minimally invasive surgery. In recent years, it has been widely used in clinical diagnosis and treatment. Through trauma control, it can effectively reduce the adverse effects of surgery on the body, reduce the physical and mental burden of patients, and provide a good physiological basis for early postoperative rehabilitation. However, laparoscopic surgery still belongs to the scope of invasive operation, and the establishment of carbon dioxide pneumoperitoneum during the operation will cause a certain degree of organ tissue pulling [9-10], and the above stimulation will still cause different degrees of postoperative pain response. Elderly patients undergoing laparoscopic surgery have certain particularity. There are more underlying diseases in these patients, and the body's tolerance decreases with the increase of age, which will increase the risk of postoperative adverse events. Cognitive dysfunction is one of the most common postoperative complications in elderly patients undergoing surgery. Its occurrence is mainly related to surgical trauma, advanced age, intraoperative anesthesia and other factors [11-12], and it is manifested as impaired memory function, delayed response and other symptoms. Some patients may also have impaired speech function and even reduced self-care ability [13]. It will have a serious negative impact on postoperative rehabilitation. Effective control of early postoperative cognitive impairment is directly related to postoperative rehabilitation and long-term prognosis.

This study mainly analyzed the application effects of TAPB and PCIA in elderly patients undergoing laparoscopic surgery. It showed that the VAS scores of patients in the study group were lower than those in the control group at 12h and 36h after surgery, and the incidence of agitation was lower than that in the control group. The combination of TAPB and PCIA could further improve the postoperative analgesia effect. Transverse abdominalis plane block is aimed at the nerves in the transverse abdominalis plane, such as L1 nerves, T6~T12 nerves and other innervated areas, covering the skin muscles and other tissues on the front side of the abdominal wall, and the skin area of the lower abdomen, etc. Through the injection of anesthetic liquid between the transverse abdominalis and
the internal oblique abdominis, it can play a better regional nerve block effect and ensure postoperative analgesia. Compared with postoperative self-controlled intravenous analgesia, transversal plane block is more targeted and can relieve early postoperative abdominal incision pain. This study also compared the cognitive function and early rehabilitation of the two groups of patients, showing that the MMSE scores of the study group were higher than those of the control group at 24h and 72h after surgery. Meanwhile, the first postoperative feeding, leaving bed, time to vent, defecation and perioperative hospital stay of the study group were shorter than those of the control group. The early postoperative cognitive function of patients in the study group was better than that of the control group, which may be associated with the implementation of TAPB to reduce the number of pump injection in postoperative self-controlled intravenous analgesia and control the dosage of anesthetic liquid, which is conducive to the recovery of postoperative cognitive function. The early recovery effect of patients in the study group was better than that of the control group, mainly related to the better postoperative analgesia effect of patients in the study group. The control of early postoperative pain can provide support for postoperative eating and leaving bed, etc., and promote postoperative rehabilitation.

In summary, the application of TAPB combined with PCIA in elderly patients undergoing laparoscopic surgery has outstanding analgesic effect, which is conducive to reducing the risk of postoperative agitation, promoting the recovery of cognitive function, and ensuring the early rehabilitation effect.

References


[8] Zhou WQ. Application of different doses of dexmedetomidine combined with Ropivacaine transversal plane block in elderly patients undergoing radical resection of colorectal cancer [J]. Massage and rehabilitation Medicine, 2021, 12(18):73-76.


