Effects of Thoracic Paravertebral Nerve Block Combined with PCIA on Hemodynamics and Stress in Patients Undergoing Radical Resection of Lung Cancer

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Abstract

Objective: To study and analyze the effects of thoracic paravertebral nerve block combined with patient controlled intravenous analgesia (PCIA) on hemodynamics and stress status of patients undergoing radical resection of lung cancer. Methods: A total of 100 patients treated with radical resection of lung cancer in our hospital from February 2021 to April 2023 were selected as the study objects, and were divided into study group and control group by random number table method, with 50 cases in each group. Both groups were given general anesthesia during radical resection of lung cancer. The control group was given intravenous controlled analgesia after surgery, and the study group was given thoracic paravertebral nerve block combined with intravenous controlled analgesia after surgery. The pain, hemodynamic level and stress response of the two groups were evaluated and compared at different stages. Results: VAS scores in the study group were lower than those in the control group at 2h, 6h, 24h and 48h after surgery, and the difference was statistically significant (P < 0.05). Immediately after surgery, there was no statistical difference in HR, CVP and other hemodynamic indexes between the two groups (P > 0.05). 24h after surgery, the levels of HR and CVP in the study group were lower than those in the control group, with statistical significance (P < 0.05). Stress response indexes such as cortisol and norepinephrine in the study group were lower than those in the control group at 1d, 3d and 5d after surgery, and the difference was statistically significant (P < 0.05). Conclusion: Thoracic paravertebral nerve block combined with PCIA can improve the early postoperative pain response, stabilize the hemodynamic level and improve the stress state in patients with lung cancer undergoing radical operation.

Keywords

Radical resection of lung cancer, Thoracic paravertebral nerve block, PCIA, Hemodynamics, Stress condition

Lung cancer is the most common malignant disease in the world, which can be divided into two categories according to biological characteristics, namely non-small cell lung cancer and small cell lung cancer, with the former being the most common [1-2]. The initial symptoms of patients with this disease are not typical, so most of them

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are already in the middle and late stages of diagnosis when admitted to hospital, which increases the difficulty of clinical diagnosis and treatment, which is also one of the main reasons for the high death rate of lung cancer [3-4]. Radical resection of lung cancer is the main way of lung cancer treatment at present. Under the background of the development of minimally invasive technology, the promotion of thoracoscopic and other minimally invasive technology provides a new choice for the treatment of lung cancer patients. In the perioperative diagnosis and treatment of radical resection of lung cancer, postoperative pain is the focus of attention [5]. If pain is not effectively controlled, it will affect the early postoperative rehabilitation effect of patients, and even cause secondary chronic pain, which has a great impact on the quality of life of patients [6-7]. Patient controlled intravenous analgesia (PCIA) is the most widely used postoperative analgesia. It is easy for patients to pump analgesia drugs according to their own pain response, but it is difficult for some patients to obtain ideal analgesia effect. Thoracic paravertebral nerve block is a block technique that directly acts on the thoracic paravertebral nerve. The analgesic drug is injected at the corresponding location, and the anesthetic drug is extended to the innervated area to ensure the analgesic effect. In this study, we analyzed the effect of thoracic paravertebral nerve block combined with PCIA on some patients with lung cancer treated in our hospital in recent years.

1. Data and methods

1.1 General Information

A total of 100 patients undergoing radical resection of lung cancer treated in our hospital from February 2021 to April 2023 were selected as the study objects, and were divided into study group and control group by random number table method, with 50 cases in each group. In the study group, there were 34 males and 16 females, aged 44~76 (59.68±6.51) years old, and in the control group, there were 36 males and 14 females. Patients aged 45 to 74 (60.49±6.82) years, there was no significant difference in general data between the two groups (P > 0.05). Inclusion criteria: (1) Patients who met the diagnostic criteria for lung cancer [8] and were confirmed; (2) Patients who meet the surgical indications for radical resection of lung cancer and receive elective surgical treatment; (3) Patients with no history of thoracic and abdominal surgery; (4) Patients who meet the indications for the use of anesthesia in this study. Exclusion criteria: (1) Patients with malignant diseases other than lung cancer; (2) Patients with organic diseases of important organs other than lungs; (3) Abnormal mental and psychological conditions; (4) Poor control of underlying diseases; (5) Patients with immune system disease; (6) Moderate and severe malnutrition.

1.2 Method

Patients in both groups were given general anesthesia during radical resection of lung cancer, and all examinations and preparations were improved before surgery. Patients and their families signed informed consent related to surgery and anesthesia. After entering the operating room, oxygen treatment was given, and intravenous channels were opened and fluid was replenished according to surgical requirements. The vital signs monitor was connected to monitor heart rate, SpO2 and respiration. Tracheal intubation mechanical ventilation treatment, propofol, remifentanil and other maintenance anesthesia. After the operation, the patient was transferred to PACU for observation.

1.2.1 Control group

PCIA was performed after surgery, and PCIA analgesia pump is formulated with sufentanil 100ug and Ondansetron 16mg, diluted to 100ml with normal saline. The background dose is 2ml/Hr. The Bonus dose is 2ml/dose, and the locking time was 15min. The patient was safely transferred back to the ward, and the use of the PCIA pump was introduced to the patient and his family.

1.2.2 Study group

Thoracic paravertebral nerve block combined with PCIA was performed after the operation, and the anesthetic drug was selected as 0.5% ropivacaine and the dose was 20ml. The patient remained in a lateral position, the skin of the puncture site was exposed and disinfected, and the location was performed under the guidance of high-frequency linear array ultrasound. The space between the costotransverse ligament, transverse process and pleura was located in the adjacent area of the thoracic vertebra of T5, and the puncture was performed in the transverse plane. After no abnormal extraction, the puncture was performed into the paravertebral space, and anesthetic drugs were injected. At the same time, the peripheral nerve controlled analgesia pump was connected, and the background dose was set at 0.2% ropivacaine, 8ml/hr, the single dose was 5ml, and the locking time was 1h. The patient was safely transferred back to the ward, and the use of the self-controlled analgesic pump was introduced to
the patient and his family.

1.3 Observation index

1.3.1 Evaluation of pain at different stages after surgery
Visual analog scale (VAS) was used to quantitatively evaluate the pain of each patient at 2h, 6h, 24h, 48h and other stages after surgery, all of which were measured in the resting state, with a total score of 10, the higher the score, the more severe the pain.

1.3.2 Hemodynamic level assessment
Hemodynamic indexes of each patient, including heart rate (HR) and central venous pressure (CVP), were monitored immediately and 24h after surgery.

1.3.3 Stress response assessment
5ml of peripheral venous blood was collected from each patient at 1d, 3d and 5d after surgery, and sent to the laboratory for the determination of stress response indicators. The level of cortisol was determined by automatic biochemical analyzer, and the level of norepinephrine was determined by enzyme-linked immunosorbent assay.

1.4 Statistical methods
SPSS23.0 statistical software was used for processing, measurement data were expressed as (x̄ ± s), comparison was performed by t test, count data were expressed as percentage, comparison was performed by χ² test, P < 0.05 was considered statistically significant.

2. Results

2.1 Comparison of postoperative pain in different stages between the two groups
VAS scores in the study group were lower than those in the control group at 2h, 6h, 24h and 48h after surgery, with statistical significance (P < 0.05), as shown in Table 1.

<table>
<thead>
<tr>
<th>Group</th>
<th>2h postoperatively (points)</th>
<th>6h postoperatively (points)</th>
<th>24h postoperatively (points)</th>
<th>48h postoperatively (points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research group/50</td>
<td>3.11±0.56</td>
<td>3.32±0.49</td>
<td>2.13±0.58</td>
<td>2.09±0.57</td>
</tr>
<tr>
<td>Control group/50</td>
<td>4.02±0.60</td>
<td>4.13±0.58</td>
<td>3.30±0.71</td>
<td>3.11±0.76</td>
</tr>
<tr>
<td>t</td>
<td>7.840</td>
<td>7.543</td>
<td>9.024</td>
<td>7.592</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>
</tr>
</tbody>
</table>

2.2 Postoperative hemodynamic level comparison between the two groups
Immediately after surgery, there was no statistical difference in HR, CVP and other hemodynamic indexes between the two groups (P > 0.05); 24h after surgery, the levels of HR and CVP in the study group were lower than those in the control group, with statistical significance (P < 0.05), as shown in Table 2.

<table>
<thead>
<tr>
<th>Group</th>
<th>HR (times/min)</th>
<th>CVP (cmH₂O)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Immediately after surgery</td>
<td>24h postoperatively</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Immediately after surgery</td>
</tr>
<tr>
<td>Research group/50</td>
<td>75.29±6.96</td>
<td>73.49±5.52</td>
</tr>
<tr>
<td>Control group/50</td>
<td>75.23±6.32</td>
<td>78.74±4.20</td>
</tr>
<tr>
<td>t</td>
<td>0.045</td>
<td>5.352</td>
</tr>
<tr>
<td>P</td>
<td>0.964</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
2.3 Comparison of stress response indexes at different stages between the two groups

Stress response indexes such as cortisol and norepinephrine in the study group were lower than those in the control group at 1d, 3d and 5d after surgery, with statistical significance \((P < 0.05)\), as shown in Table 3.

<table>
<thead>
<tr>
<th>Group</th>
<th>1d postoperatively</th>
<th>3d postoperatively</th>
<th>5d postoperatively</th>
<th>1d postoperatively</th>
<th>3d postoperatively</th>
<th>5d postoperatively</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Group/50</td>
<td>432.39±50.62</td>
<td>280.31±46.59a</td>
<td>165.42±39.48b</td>
<td>173.49±20.41</td>
<td>150.19±23.84</td>
<td>87.49±9.85b</td>
</tr>
<tr>
<td>Control Group/50</td>
<td>484.59±54.23</td>
<td>328.49±50.12a</td>
<td>209.41±44.29b</td>
<td>230.32±28.31</td>
<td>180.25±25.21a</td>
<td>117.49±14.27b</td>
</tr>
<tr>
<td>(t)</td>
<td>4.976</td>
<td>4.979</td>
<td>5.243</td>
<td>11.514</td>
<td>6.158</td>
<td>12.234</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>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Note: Compared with postoperative 1d, \(P < 0.05\), compared with postoperative 3d, \(P < 0.05\)

3. Discussion

Radical resection of lung cancer is an effective way to treat lung cancer. Middle-aged and elderly people are the main group of patients with lung cancer. The sympathetic nervous system activity of this group is relatively strong, and some patients' immune function is gradually weakened due to their own disease, and their tolerance to surgery is relatively poor [9-10]. Radical resection of lung cancer may cause significant early postoperative pain and stress reaction due to greater surgical trauma. Early postoperative pain will directly increase the physical and mental burden of patients and affect the quality of early sleep. Combined with the impact of stress response [11-12], it will pose a certain threat to the surgical effect and even the life safety of patients. Therefore, effective analgesia for patients undergoing radical resection of lung cancer is extremely important. This study mainly analyzed the application effect of thoracic paravertebral nerve block combined with intravenous controlled analgesia in postoperative analgesia, and showed that compared with single intravenous controlled analgesia, the VAS scores of patients in the study group receiving combined analgesia were lower than those in the control group at 2h, 6h, 24h and 48h after surgery. Combined analgesic regimen can further enhance the analgesic effect and improve the early postoperative pain response.

The comparison of postoperative hemodynamic levels between the two groups showed that there was no statistical difference in HR, CVP and other hemodynamic indexes between the two groups immediately after surgery. The HR and CVP levels of the study group were lower than those of the control group 24 hours after surgery, and the early postoperative hemodynamic recovery of the study group was better than that of the control group. The results indicated that thoracic paravertebral nerve block on the basis of intravenous controlled analgesia could stabilize the hemodynamic level of patients. PCIA is a commonly used method for postoperative analgesia. The anesthesiologist pre-sets the dose of analgesia according to the operation conditions, and the patient pumps the analgesia after the operation, which has the advantages of simple operation, rapid effect and extensive narcotic drugs. However, PCIA is a systemic drug with certain side effects. At the same time, some patients have poor analgesic effect [13]. Thoracic paravertebral nerve block is a local drug with strong pertinence, which can ensure the analgesic effect on the basis of controlling the dosage of analgesic drugs. During the implementation of thoracic paravertebral nerve block, ultrasound guided puncture catheterization was performed to ensure the accuracy of the puncture site. Stress response indexes such as cortisol and norepinephrine in the study group were lower than those in the control group at 1d, 3d, and 5d after surgery, indicating that the improvement of early postoperative stress in the study group was better than that in the control group. The occurrence of early postoperative stress reaction in patients with radical resection of lung cancer was mainly related to surgical trauma, and surgical operation would affect the function of the body's immune system. Cause the occurrence of stress response. Thoracic paravertebral nerve block combined with PCIA can reduce the stimulation of pain response and promote the control of stress response by improving the early postoperative pain condition, thus ensuring the early postoperative rehabilitation effect.

In summary, the application of thoracic paravertebral nerve block combined with intravenous controlled analge-
sia in patients undergoing radical resection of lung cancer can promote the improvement of postoperative pain response, stabilize hemodynamics, and improve stress conditions, which is worth carrying out.

References


