Influence of the dexmedetomidine combined with parecoxib sodium on inflammatory factor, blood gas analysis and stress hormone levels in patients undergoing radical resection of esophageal carcinoma during one lung ventilation

Qian Yang, Xian-Yu Wang

Department of anesthesiology, Shiyan Taihe Hospital of Hubei (Affiliated Hospital of Hubei Medical College), Shiyan 442000, Hubei, China

ARTICLE INFO

Article history:
Received 11 Oct 2017
Received in revised form 15 Oct 2017
Accepted 18 Oct 2017
Available online 28 Oct 2017

Keywords:
Dexmedetomidine
Parecoxib sodium
Radical resection of esophageal cancer
One lung ventilation
Biochemical index

ABSTRACT

Objective: To investigate the effect of dexmedetomidine combined with parecoxib sodium on the levels of inflammatory factors, blood gas analysis and stress hormone in patients undergoing radical resection of esophageal carcinoma during one lung ventilation. Methods: According to the random data table, 81 cases of esophageal cancer patients were divided into the control group (n=41) and observation group (n=40), the patients in the two groups underwent left thoracotomy esophageal cancer radical resection, the control group patients were treated with parecoxib sodium, and patients in the observation group were treated with parecoxib sodium combined with dexmedetomidine medetomidine treatment, before induction of anesthesia (T₀), 30 min of one lung ventilation (T₁) and 120 min after operation (T₂) at three time points, the levels of inflammatory factors [tumor necrosis factor-α (TNF-α), C reactive protein (CRP)], blood gas analysis [oxygen partial pressure (PaO₂), carbon dioxide partial pressure (PaCO₂)] and stress hormone [epinephrine (E), norepinephrine (NE)] of the two groups were compared. Results: Intra group level comparison, compared with the levels of two groups at the T₀ moment, the levels of TNF-α, CRP and NE of the T₁ and T₂ moment were significantly increased, the level of PaO₂ were significantly decreased, and T₂ moment levels were significantly higher than that of T₁ moment, the difference was statistical significance; There were no significant differences between the two groups of the levels of TNF-α, CRP, PaO₂, E and NE of the T₀ moment, the levels of TNF-α, CRP, PaO₂ and NE of the observation group at the T₁ and T₂ moment were significantly lower than the control group, at the same time the PaO₂ level was significantly higher than the control group, the difference was statistically significant; There were no statistically significant differences in PaCO₂ levels between groups and at any time. Conclusion: Dexmedetomidine combined with parecoxib sodium can effectively relieve the inflammatory stress, improve the levels of the blood gas analysis index and stress hormone during one lung ventilation, has an important clinical value.

1. Introduction

One-lung ventilation is a special ventilation technique commonly used in cardiothoracic surgery. It has the effects of preventing the exudates of lungs on operated side as well as the cross-infection of blood and pathogens, also effective in removing airway secretions and so on. It has important value for tumor resection and metastatic lymph node dissection[1,2]. As a non-physiological ventilation, one lung ventilation may easily lead to hypoxemia, ventilation-related lung injury, and thus seriously affect the safety and postoperative recovery of patients with periooperative[3]. Related studies have shown that the monotherapy treatment of dexmedetomidine and parecoxib sodium has a significant improvement in inflammatory factors and lung oxygen of one lung ventilation[4,5], but there is few report on the joint use of both. The aim of this study was to explore inflammatory factors, blood gas analysis and stress hormones in order to clarify the clinical efficacy of combined use of dexmedetomidine and parecoxib sodium.

Corresponding author: Xian-Yu Wang, Department of anesthesiology, Shiyan Taihe Hospital of Hubei (Affiliated Hospital of Hubei Medical College), Shiyan 442000, Hubei, China.
E-mail: yangqian6746@163.com
Fund Project: Hubei Provincial Department of Science and Technology Project (Num: EK2015D414124004560).
2. Objects and Methods

2.1 Objects

A total of 81 cases of radical resection of esophageal cancer patients from May, 2015 to July, 2017 in our hospital were selected as research objects. The study was conducted in accordance with the standards of the Hospital Ethics Committee and was approved by the Ethics Committee. 81 cases of radical resection of esophageal cancer patients were randomly divided into two groups, control group (n=41) and observation group (n=40). In control group, there were 23 males and 18 females, with ages of 45-77 years; In observation group, there were 21 males and 19 females, with ages of 46-75 years. The TNM stages of patients with esophageal carcinoma belongs to stage I - II, ASA grade belongs to I - II level. Preoperative pulmonary function is normal or accompanied by mild pulmonary ventilation disorder. Patients can tolerate surgery, and there were not radiotherapy and chemotherapy before surgery. Liver and kidney function and other laboratory tests of the patients were no significant abnormalities, also there were no lung infection, no hormones, non-steroidal drug treatment history recently. And excluded: part of the stage III and IV esophageal cancer patients diagnosed invasion of the aorta and tracheal; cardiopulmonary dysfunction or associated with other organ system lesions, and intolerant surgery; hemodynamic instability, intraoperative blood loss greater than 800 mL; one lung ventilation time less than 2 h.

2.2 Therapeutic method

The patients in the two groups underwent left thoracotomy esophageal cancer radical resection. Preoperative fasting forbidden. After admission, the open vein circuit was conduct regularly. Monitoring heart rate, electrocardiogram, blood pressure, mean arterial pressure of oxygen (PaO₂) and carbon dioxide partial tension (PaCO₂) levels. Preoperative (T0) and stress hormone (epinephrine (E) and norepinephrine (NE)) were measured at three time points before anesthesia induction (T0), one lung ventilation for 30 min (T1) and 120 min after operation (T2). The levels of TNF-α and CRP were measured by enzyme-linked immunosorbent assay (ELISA). PaO₂, PaCO₂ levels were measured directly using blood gas analyzer. E and NE were measured by chemiluminescence method, the used instrument was Roche Electrochemical Luminescence Analyzer. Detection kits are purchased from Shanghai enzyme Biotechnology Co., Ltd. All operations were carried out in strict accordance with the test kit instructions.

2.4 Statistical analysis

The original data of the study were recorded into SPSS 17.0 statistical software for statistical processing. Inflammatory factors, blood gas analysis and stress hormone levels were all tested by normal distribution and variance homogeneity, and described as the mean ± standard deviation (Mean ± SD). Multiple time points in the group were compared using repeated measurements of variance analysis. The same time point index comparison between the two groups used group design t test, values of P<0.05 were considered to be statistically significant.

3. Results

3.1 Comparison of inflammatory factors before and after anesthesia

Table 1.

Comparison of inflammatory factors before and after anesthesia.

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>Time</th>
<th>TNF-α (ng/L)</th>
<th>CRP (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>41</td>
<td>T₀</td>
<td>15.45±2.94</td>
<td>11.93±3.27</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T₁</td>
<td>32.81±5.36</td>
<td>32.94±4.38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T₂</td>
<td>35.02±2.48</td>
<td>46.12±4.88</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T₃</td>
<td>16.01±2.85</td>
<td>11.76±3.02</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T₁</td>
<td>22.92±1.44</td>
<td>28.43±4.56</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T₂</td>
<td>24.42±3.66</td>
<td>33.45±4.69</td>
</tr>
</tbody>
</table>

Note: Compared with the level of T₀ in the group, bP<0.05; compared with the T₁ level in the group, aP<0.05; compared with the same time the control group, P<0.05.
Table 2.
Comparison of blood gas before and after anesthesia.

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>Time</th>
<th>PaO2 (mmHg)</th>
<th>PaCO2 (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>41</td>
<td>T0</td>
<td>398.16±35.68</td>
<td>41.35±6.59</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T1</td>
<td>319.97±25.66*</td>
<td>39.45±4.13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T2</td>
<td>310.83±41.15*</td>
<td>38.71±5.86</td>
</tr>
<tr>
<td>Observation group</td>
<td>40</td>
<td>T0</td>
<td>399.53±36.76*</td>
<td>41.47±5.65</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T1</td>
<td>310.83±41.15*</td>
<td>39.85±3.41</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T2</td>
<td>353.93±32.54*</td>
<td>39.31±6.05</td>
</tr>
</tbody>
</table>

Note: Compared with the level of T0 in the group, *P<0.05; compared with the T1 level in the group, †P<0.05; compared with the same time the control group, ‡P<0.05.

Table 3.
Comparison of stress and hormone levels before and after anesthesia.

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>Time</th>
<th>E (ng/mL)</th>
<th>NE (ng/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>41</td>
<td>T0</td>
<td>76.23±13.83</td>
<td>241.08±88.14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T1</td>
<td>244.18±55.89*</td>
<td>422.71±96.54*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T2</td>
<td>270.37±72.93*</td>
<td>519.53±128.06*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T0</td>
<td>75.83±14.52</td>
<td>246.89±93.86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T1</td>
<td>157.59±67.19*</td>
<td>279.52±42.58*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T2</td>
<td>171.72±54.51*</td>
<td>313.56±98.11*</td>
</tr>
</tbody>
</table>

Note: Compared with the level of T0 in the group, *P<0.05; compared with the T1 level in the group, †P<0.05; compared with the same time the control group, ‡P<0.05.

1.44 ng/L, (28.43 ± 4.56) mg/L, (24.42 ± 3.66) mg/L, (33.45 ± 4.69) mg/L were significantly lower than these in control group (32.81 ± 5.36) ng/L, (32.94 ± 4.38) mg/L, (35.02 ± 2.48) mg/L, (46.12 ± 4.88) mg/L] at the same time point. The difference was statistically significant (P<0.05).

3.2 Comparison of blood gas before and after anesthesia

Compared with the level of T0 in the same group, the levels of PaO2 were significantly decreased at both T1 and T2 groups, and the levels at T2 was significantly higher than that of T1, the difference was statistically significant (P<0.05). Comparison between groups: there was no significant difference in PaO2 level between the two groups (P>0.05). The levels at T1 and T2 in the observation group [(310.83±41.15) mmHg, (353.93 ± 32.54) mmHg], were significantly higher than that in the control group [(277.29 ± 46.04) mmHg, (319.97 ± 25.66) mmHg] (P<0.05). There was no significant difference in PaCO2 level between the two groups (P> 0.05).

3.3 Comparison of stress and hormone levels before and after anesthesia

The levels of E and NE in patients at T0, T1 and T2 were shown in Table 2. Compared with the levels at T0 in the same group, the levels at T2 were increased significantly, and the levels at T2 [(270.37±72.93) ng/mL, (519.53±128.06) ng/mL] were significantly higher than that of T1 [(244.18±55.89) ng/mL, (422.71±96.54) ng/mL] (P<0.05), the difference was statistically significant (P<0.05). Compared with the levels of E and NE at T0, the levels at T1 and T2 in the observation group were significantly increased. There was no significant difference of level of E between T2 and T1 (P>0.05). Also, there was no significant difference at T0 between the two groups at the same time (P>0.05). The levels of E and NE in the observation group at T1 and T2 were significantly lower than those in control group. The difference was statistically significant (P<0.05).

4. Discussion

One lung ventilation technology is widely used in the esophageal, lobe and total lung treatment. The development of it provide a reliable guarantee for the application of thoracoscopic minimally invasive technology. However, due to intraoperative lung ventilation and blood flow imbalance, it may easily lead to hypoxemia, secondary ventilator-associated pneumonia, even acute respiratory distress syndrome, which was a serious threat to the safety of patients[7]. Therefore, reducing single lung ventilation when lung injury has great value to improve the overall treatment effect and prognosis, and it has become the key point for clinical research in recent years. Parecoxib sodium is a nonsteroidal anti-inflammatory drug, mainly function by inhibiting cyclooxygenase-2 (COX-2, a proinflammatory factor, one of the important inducing factors of lung injury) expression to reduce the body’s inflammatory stress response[8,9]. Dexametomidine is a novel and highly selective adrenergic receptor agonist, may reduce blood pressure, heart rate, stable hemodynamics, relieve oxidative stress, inhibit the release of inflammatory factors, and can be widely used in clinical anesthesia[10,11]. The aim of this study was to analyze inflammatory stress, blood gas analysis and stress hormones, to clarify the efficacy of dextromethorphan combined parecoxib sodium.)

The pathology of one lung ventilation caused by lung injury is more complex, which still not clear yet. In recent years, the relevant studies have shown that the pathogenesis of lung injury is related to the oxidative stress, inflammatory stress and immune dysfunction and other series of cascade induced by pulmonary hypoxia-ischemia. A large number of studies have confirmed that the body synthesis and release of stress response-related cytokine levels and lung injury was significantly correlated[14]. At present, inflammatory stress is considered to be one of the major causes of acute lung injury. TNF-α and CRP are important factors to reflect the degree of inflammation. The level of TNF-α and CRP is closely related to lung injury[15,16]. The results of this study pointed out that the level of inflammatory factors in patients with one lung ventilation were significantly increased, revealing the body produced a chronic inflammatory response. However, compared with the use of parecoxib sodium alone, patients combined with dexametomidine...
had showed a significant increase in the level of inflammatory factors, which indicating that dexmedetomidine can effectively inhibit the release of inflammatory factors, reduce inflammatory stress response. The results of the study were consistent with the previous reports, further confirming the antiemetic effect of dexmedetomidine[17,18].

PaO₂ and PaCO₂ are important indicators of lung injury. One lung ventilation caused lung injury, and further makes the lung gas exchange capacity decreased, manifesting as ventilation and ventilation reduction (PaO₂ and PaCO₂ levels decreased); It indicated that single lung ventilation, the cavity of non-ventilated side of the lungs increased, and the contralateral pulmonary blood flow shunt increased, resulting in a serious imbalance in a double lung ventilation/blood flow ratio, making the lung ventilation and diffuse function decreased[19,20]. The results of this study indicated that PaO₂ levels were significantly lower in the one lung ventilation compared with the T0 level, but the difference between the two groups was not significant, indicating that there was lung injury in patients with single lung ventilation. Compared with the control group, the PaO₂ level was significantly decreased in the one lung ventilation group, and the blood gas analysis index of the patients was significantly improved. It is suggested that the combination with dexmedetomidine has a protective effect on lung function, which may be related to the factors such as the reduction of inflammatory stress and oxidative stress in the lungs.

E and NE are commonly used indicators of surgical stress. The study pointed out that postoperative pain can cause E and NE levels increased, the level of it was significantly positively correlated to stress intensity. The results of this study showed that after lung injury caused by one lung ventilation, E and NE levels of patients were significantly increased, revealing there is a significant stress response. The levels of E and NE in patients treated with dexmedetomidine were significantly lower than those in the control group, which indicated that the combined group of patients with mild stress response. The results suggested that dexmedetomidine can effectively reduce the level of stress hormone in patients, the reason of it may be related to the inhibition effect of dextromethorphan on the sympathetic and catecholamine release[23].

In summary, esophageal cancer radical surgery in one lung ventilation may cause lung injury, which may lead to the increase of inflammatory factors release, abnormalities of blood gas analysis, and a strong stress response. Compared with simple parecoxib sodium treatment, combined with dexmedetomidine can effectively reduce the inflammatory response of one lung ventilation, improve the level of blood gas analysis indicators, protect lung function. Also it has important value to reduce the level of stress hormones and improve the operation and anesthesia effect and improve the prognosis.

References


