Effects of video-assisted thoracoscopic surgery and traditional thoracotomy on systemic inflammatory response and stress response of traumatic hemopneumothorax

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ABSTRACT

Objective: To study the effects of video-assisted thoracoscopic surgery and traditional thoracotomy on the systemic inflammatory response and stress response of traumatic hemopneumothorax. Methods: Patients who underwent emergency surgery due to traumatic hemopneumothorax in Chongzuo People’s Hospital between May 2013 and April 2017 were selected as the research subjects, the history data were retrospectively analyzed, and the surgical methods were referred to divide the patients into the thoracoscope group and the thoracotomy group who received video-assisted thoracoscopic surgery and traditional thoracotomy respectively. The serum samples were collected the same day after surgery and 3 d after surgery to determine the contents of acute phase proteins CRP, ChE and SAA, inflammatory cytokines TNF-α, IL-1β, IFN-γ, MCP-1 and ICAM-1 as well as stress hormones Cor, NE, Ins and AT-II. Results: The same day after surgery and 3 days after surgery, serum CRP, ChE, SAA, TNF-α, IL-1β, IFN-γ, MCP-1, ICAM-1, Cor, NE, Ins and AT-II levels of thoracoscope group were all significantly lower than those of thoracotomy group. Conclusions: Video-assisted thoracoscopic surgery for traumatic hemopneumothorax is more effective than traditional thoracotomy to relieve the postoperative systemic inflammatory response and stress response, and helps the postoperative recovery.

1. Introduction

Traumatic hemopneumothorax is a common thoracic emergency mostly caused by the pleura and vascular damage after post-traumatic multiple rib fractures, which progresses rapidly and will develop into hemorrhagic shock and acute respiratory distress in a short period of time and be life-threatening[1,2]. Due to the critical condition of traumatic hemopneumothorax, it is not good to rely solely on the thoracic closed drainage, and emergency surgery is mostly needed for treatment. The thoracotomy is the clinical traditional way to treat traumatic hemopneumothorax, but it has the disadvantages such as large surgical trauma, inadequate field exposure and incomplete exploration. Video-assisted thoracoscopic surgery is the minimally invasive surgery with wide application in recent years, and the use of video-assisted thoroscope can obtain clear surgical vision, decrease the surgical trauma and ensure the completeness of probing[3]. In the following studies, we specifically analyzed the different value of video-assisted thoracoscopic surgery and traditional thoracotomy for traumatic hemopneumothorax from the perspectives of systemic inflammatory response and stress response.

2. Materials and methods

2.1. Clinical case information

Patients who underwent emergency surgery due to traumatic hemopneumothorax in Chongzuo People’s Hospital between May 2013 and April 2017 were selected as the research subjects, the history data were retrospectively analyzed, and the surgical methods were referred to divide the patients into the thoracoscope
group and the thoracotomy group. The clinical data of both groups were complete and the serum samples were collected on the day after surgery and 3 days after surgery. There were 48 cases in thoracoscope group, including 29 males and 19 females who were 24-52 years old; there were 62 cases in thoracotomy group, including 38 males and 24 females who were 22-54 years old. There was no significant difference in general information between the two groups of patients.

2.2. Surgical methods

Thoracotomy group underwent thoracotomy, and the method was as follows: double-lumen endotracheal intubation was done after general anesthesia, the patients lay on the healthy side and received contralateral lung ventilation, the injury site was referred to select operation incision, thorough hemostasis was done after exploratory thoracotomy, the seriously injured lung tissue was removed, silk was used for suture and repair, and the area with obvious rib fracture underwent plate osteosynthesis. Thoracoscope group underwent video-assisted thoracoscopic surgery, which was as follows: anesthesia and intubation methods were the same as those of thoracotomy group, the patients lay on the healthy side, the thoracoscope probe was placed between No. 6 and No. 7 rib in the affected-side to probe intrathoracic bleeding area, then electrocaugulation, transfixion, titanium clip clipping and other methods were adopted for hemostasis, the area with pulmonary laceration underwent wedge resection by disposable intracavitary linear cut stapler, and the area with obvious rib fracture underwent plate osteosynthesis.

2.3. Clinical index detection

The same day after surgery and 3 d after surgery, 3-5 mL of cubital venous blood was collected from two groups of patients and centrifuged to separate serum, and then enzyme-linked immunosorbent assay kit was used to determine CRP, ChE, SAA, TNF-α, IL-1β, IFN-γ, MCP-1, ICAM-1, Cor, NE, Ins and AT-II levels.

2.4. Statistical methods

SPSS 23.0 software was used to input and analyze data, measurement data analysis between two groups was by t test and the differences in test results were statistically significant if \( P<0.05 \).

3. Results

3.1. Serum acute phase protein levels

Serum CRP, ChE and SAA levels of thoracoscope group were all significantly lower than those of thoracotomy group (Table 1) \( (P<0.05) \).

3.2. Serum inflammatory cytokine levels

Serum TNF-α, IL-1β, IFN-γ, MCP-1 and ICAM-1 levels of thoracoscope group were all significantly lower than those of thoracotomy group \( (P<0.05) \) (Table 2).

3.3. Serum stress hormone levels

Serum Cor, NE, Ins and AT-II levels of thoracoscope group were all significantly lower than those of thoracotomy group \( (P<0.05) \) (Table 3).

4. Discussion

Traumatic hemopneumothorax is a severe thoracic disease, rapid blood volume loss will increase the risk of hemorrhagic shock, the resulting pneumothorax will affect the ventilation and gas exchange.
and operation trauma in the body stress is the major change in the process of external violent trauma inflammatory response.

of acute phase proteins and reduce the activation degree of systemic traumatic hemopneumothorax can reduce the synthesis and secretion This shows that video-assisted thoracoscopic surgery treatment of thoracotomy group the same day after surgery and 3 d after surgery. In order to define the differences in systemic inflammatory response after video-assisted thoracoscopic surgery and thoracotomy treatment of traumatic hemopneumothorax can be obtained a clear view of the operation, fully detect the injured site and completely stop the bleeding[5,6].

In recent years, domestic scholars have reported that video-assisted thoracoscopic surgery for traumatic hemopneumothorax can decrease the postoperative drainage, shorten the time of postoperative chest drainage and help to reduce postoperative wound and promote postoperative recovery[7]. Excessive activation of inflammation and stress is the major change in the process of external violent trauma and operation trauma in the body[8,9], but there is no report about the change of systemic inflammatory response and stress response after video-assisted thoracoscopic surgery in the treatment of traumatic hemopneumothorax.

When the body undergoes trauma, operation and other processes, the excessive activation of inflammatory response in the body can cause changes in the secretion of various acute phase proteins. CRP and SAA are the acute phase proteins synthesized by the liver, the liver cells massively synthesize CRP and SAA and secrete them into the blood circulation under the action of TNF-α, IL-1β and other pro-inflammatory factors in the process of trauma, and serum CRP and SAA contents can reflect the degree of inflammatory response.

ChE is a glycoprotein widely distributed in various tissues and organs of the whole body. In the process of inflammatory reaction, the changes of vascular permeability and the enhancement of catabolism in local tissue can lead to the increase of ChE secretion. In order to define the differences in systemic inflammatory response after video-assisted thoracoscopic surgery and thoracotomy treatment of traumatic hemopneumothorax, the changes in serum contents of above inflammatory cytokines were analyzed after operation, and the results showed that serum TNF-α, IL-1β, IFN-γ, MCP-1 and ICAM-1 levels of thoracoscope group were all significantly lower than those of thoracotomy group the same day after surgery and 3 d after surgery. It further shows that video-assisted thoracoscopic surgery for traumatic hemopneumothorax is more effective than thoracotomy to reduce the synthesis and secretion of inflammatory cytokines, and relieve the activation degree of systemic inflammatory response.

External trauma, surgical operation and inflammatory response over-activation are all intense stressors for the body, which can activate the body’s stress response and cause a variety of endocrine hormones to change. Adrenal gland is the endocrine gland playing an important role in the process of stress reaction, cortex and medulla can adjust vasomotor and ensure the blood supply to the body

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>Time</th>
<th>Cor (nmol/L)</th>
<th>NE (ng/mL)</th>
<th>Ins (U/L)</th>
<th>AT-II (ng/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thoracoscope group</td>
<td>48</td>
<td>Same day after surgery</td>
<td>203.5±31.2</td>
<td>60.23±8.29</td>
<td>9.29±1.08</td>
<td>19.28±2.42</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 d after surgery</td>
<td>181.2±24.8</td>
<td>49.81±6.57</td>
<td>7.31±0.93</td>
<td>16.57±2.13*</td>
</tr>
<tr>
<td>Thoracotomy group</td>
<td>62</td>
<td>Same day after surgery</td>
<td>244.1±39.5</td>
<td>79.51±9.52</td>
<td>13.52±1.89</td>
<td>25.24±3.28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 d after surgery</td>
<td>227.5±31.8</td>
<td>71.24±8.38</td>
<td>11.72±1.47</td>
<td>21.55±2.98</td>
</tr>
</tbody>
</table>

*: Comparison between thoroscope group and thoracotomy group, P<0.05.

In the process of inflammatory response, the activation of a variety of inflammatory cells and the secretion of inflammatory cytokines are the important features, and also the important causes of local tissue injury and acute phase protein change[10]. TNF-α and IL-1β are the pro-inflammatory factors changing in the early inflammatory response, which are synthesized and secreted by mononuclear macrophages, participate in the start of the inflammatory response, and can recruit and activate a variety of inflammatory cells in local inflammatory area so as to promote the secretion of other inflammatory mediators and mediate the cascade amplification of inflammatory response[11,12]; IFN-γ is secreted by Th1 lymphocytes and can directly participate in the inflammatory response damage to tissue[13,14]; MCP-1 and ICAM-1 are the inflammatory cytokines with chemotactic activity and intercellular adhesion activity respectively, the former can mediate monocyte infiltration in local inflammatory area, and the latter can mediate the migration of a variety of inflammatory cells to the local inflammatory response. In order to further clarify the differences in systemic inflammatory response after video-assisted thoracoscopic surgery and thoracotomy treatment of traumatic hemopneumothorax, the changes in serum contents of above inflammatory cytokines were analyzed after operation, and the results showed that serum TNF-α, IL-1β, IFN-γ, MCP-1 and ICAM-1 levels of thoracoscope group were all significantly lower than those of thoracotomy group the same day after surgery and 3 days after surgery. It further shows that video-assisted thoracoscopic surgery for traumatic hemopneumothorax is more effective than thoracotomy to reduce the synthesis and secretion of inflammatory cytokines, and relieve the activation degree of systemic inflammatory response.

External trauma, surgical operation and inflammatory response over-activation are all intense stressors for the body, which can activate the body's stress response and cause a variety of endocrine hormones to change. Adrenal gland is the endocrine gland playing an important role in the process of stress reaction, cortex and medulla synthesize and secrete Cor and NE respectively, the former can mediate monocyte infiltration in local inflammatory area, and the latter can adjust vasomotor and ensure the blood supply to the body.
vasomotor activity in the body, and the activation of the system in the process of stress reaction will increase the AT-II secretion to affect vasomotor state[18]. In order to define the differences in systemic stress reaction after video-assisted thoracoscopic surgery and thoracotomy treatment of traumatic hemopneumothorax, the changes in serum contents of above stress hormones were analyzed after operation, and the results showed that serum Cor, NE, Ins and AT-II levels of thoracoscope group were all significantly lower than those of thoracotomy group the same day after surgery and 3 d after surgery. This indicates that video-assisted thoracoscopic surgery for traumatic hemopneumothorax is more effective than thoracotomy in reducing the synthesis and secretion of stress hormones and reducing the activation degree of systemic stress response.

Video-assisted thoracoscopic surgery for traumatic hemopneumothorax causes fewer traumas than traditional thoracotomy, and can reduce the secretion of acute phase proteins, inflammatory cytokines and stress hormones to alleviate postoperative systemic inflammatory response and stress response and help postoperative recovery.

References


