The levels of serum cystatin C, brain natriuretic peptide in traumatic patients and correlation analysis with traumatic severity

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ABSTRACT

Objective: To observe the levels of serum cystatin C (Cys C), brain natriuretic peptide (BNP) in traumatic patients and correlation analysis with traumatic severity. Methods: 120 emergency traumatic patients in emergency department of our hospital were rolled from December 2015 to December 2016, who were divided into minor trauma group (n=41), severe trauma group (n=43) and critical trauma group (n=36) according to the injury severity score (ISS). The levels of serum Cys C, BNP of the patients in the 3 groups were detected on 0 h, 24 h, 3 d and 7 d after admission respectively. Pearson correlation analysis of the levels of serum Cys C, BNP and ISS. Results: There were no significant differences in the levels of serum Cys C, BNP on 0 hours between the three groups; There were no significant differences in the levels of serum Cys C, BNP on 0 h, 24 h, 3 d and 7 d in minor trauma group; The levels of serum Cys C, BNP on 24 h, 3 d and 7 d were all higher than those of 0 h in severe trauma group, and the levels of serum Cys C on 3 d and 7 d were both higher than those of 24 h; The levels of serum Cys C, BNP on 24 h, 3 d, 7 d were all higher than those of 0 h in critical trauma group, the levels of serum Cys C, BNP on 3 d and 7 d were both higher than those of 24 h, and the levels of serum Cys C on 7 d were higher than those of 3 d; The levels of serum Cys C, BNP in severe trauma and critical trauma groups were significantly higher compared with minor trauma group on 24 h, 3 d and 7 d. Pearson correlation analysis, the level of serum Cys C were positively correlated with ISS, the level of serum BNP were positively correlated with ISS. Conclusion: Different levels of traumatic patients had different levels of serum Cys C, BNP increased at different times. Pearson correlation analysis showed that the levels of serum Cys C, BNP were both positively correlated with traumatic severity, which suggested that the levels of serum Cys C, BNP may be important indicators of traumatic severity and could provide important reference value for clinical evaluation of traumatic severity.

1. Introduction

Trauma is common surgical emergency. Severe trauma could cause a massive loss of blood and fluid, which result the rapid decline of effective circulating blood volume plummeted, the renal perfusion pressure was significantly lower, result in renal vascular blood supply decrease, result in acute ischemic injury caused by

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severe acute renal failure and multiple organ dysfunction syndrome (MODS), even death[1,2]. Therefore, how to assess the severity of trauma in an emergency accurately, rapidly and standardly is of guiding significance for the diagnosis, treatment and prognosis. The progress and severity of renal disease are based on renal function, and renal function is generally reflected by glomerular filtration rate (GFR). Serum cystatin C (Cys C) belongs to the family of serum cysteine enzyme inhibition, could pass through the glomerular filtration membrane, almost all from the tubular reabsorption, disturbed blood sugar, inflammation and other factors. Compared with creatinine and urea nitrogen, it has higher sensitivity and specificity, and is an ideal index to reflect GFR[3]. Brain natriuretic
peptide (BNP) is mainly secreted by the heart natriuretic peptide. BNP has the function of drainage and sodium withdrawal, and has a strong vasodilator effect, which could antagonize the vasoconstrictor action of the renin angiotensin aldosterone system. BNP is an important indicator of cardiac function and prognosis in patients with heart failure[4]. Lots of studies have shown that the level of BNP is associated with the injury and prognosis of trauma patients in recent years[5-7]. In this study, the Cys C and BNP levels were detected at different time points after admission to different levels of trauma patients in our hospital, and their relationship with the injury and prognosis of the patients was analyzed. As follows.

2. Data and methods

2.1 General information

120 emergency traumatic patients in emergency department of our hospital were rolled from December 2015 to December 2016. Critically patients were accepted basic debridement and suture treatment in the emergency department, then hospitalization. There were 66 males and 54 females, aged 16-68 years. Mean age (42.2±6.54) years. Among them, there were 61 of traffic accident trauma, 29 of falling injury at high level, 17 of knife injury and 13 of other injuries. Exclusion criteria: Patients with acute and chronic cardiovascular and cerebrovascular diseases; patients with severe cardiopulmonary, liver and kidney dysfunction; various acute complications; patients with severe trauma and 36 critically trauma patients were accepted 7 d follow-up period. Among them, there were 4 patients with severe trauma and 8 critically trauma patients died due to the overweight condition in the hospital in 7 days. Serum levels of Cys C and BNP were detected by enzyme-linked immunosorbent assay (ELISA) in 3 groups.

2.2 Research methods

Trauma severity criteria were assessed by injury severity score (ISS): minor trauma≤15 points, severe trauma>15 to 25 points, critically trauma≥25 points. According to the ISS scoring standard, 120 patients were divided into 3 groups: minor trauma group, severe trauma group and critically trauma group. There were 41 patients with minor trauma, 22 males and 19 females, aged 16-65 years, with an average age of (46.4±5.82) years. There were 43 patients with severe trauma, 21 males and 22 females, aged 22-68 years, with an average age of (45.7±4.32) years. There were 36 critically trauma patients, 19 males and 17 females, aged 18-62 years, with an average age of (44.8±4.96) years. There were no significant differences in the general data of the three groups (P>0.05). Venous blood samples of 3 groups were collected at 0 h, 24 h, 3 d and 7 d after admission, and serum samples were centrifuged and stored at -70 °C for examination. A total of 31 patients with minor trauma, 39 patients with severe trauma and 36 critically trauma patients were accepted 7 d follow-up period. Among them, there were 4 patients with severe trauma and 8 critically trauma patients died due to the overweight condition in the hospital in 7 days. Serum levels of Cys C and BNP were detected by enzyme-linked immunosorbent assay (ELISA) in 3 groups.

2.3 Statistical methods

The experimental data were processed by SPSS 19.0 software, and the measured data was expressed by mean ± standard deviation. Multiple groups were analyzed by variance analysis, and two groups comparison were analyzed by t test. Correlation analysis using Pearson correlation analysis. The test level was α = 0.05, and P<0.05 was statistically significant.

3. Results

3.1 Comparison of serum Cys C levels at different stages between 3 groups patients

There were no significant differences in the levels of serum Cys C on 0 hours between the three groups (P>0.05); There were no significant differences in the levels of serum Cys C on 0 h, 24 h, 3 d and 7 d in minor trauma group (P>0.05); The levels of serum Cys C on 24 h, 3 d and 7 d were all higher than those of 0 h in severe trauma group (P<0.05), and the levels of serum Cys C on 3 d and 7 d were both higher than those of 24 h (P<0.05); The levels of serum Cys C on 24 h, 3 d and 7 d were all higher than those of 0 h in critical trauma group (P<0.05), the levels of serum Cys C on 3 d and 7 d were both higher than those of 24 h (P<0.05), and the levels of serum Cys C on 7 d were higher than those of 3 d (P<0.05); The levels of serum Cys C in severe trauma and critical trauma groups were significantly higher compared with minor trauma group on 24 h, 3 d and 7 d (P<0.05). Table 1.

Table 1.
Serum Cys C levels at different stages between 3 groups patients (mg/L).

<table>
<thead>
<tr>
<th>Groups</th>
<th>Cases</th>
<th>0 h</th>
<th>24 h</th>
<th>3 d</th>
<th>7 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>minor trauma group</td>
<td>31</td>
<td>0.79±0.25</td>
<td>0.81±0.22</td>
<td>0.84±0.35</td>
<td>0.83±0.27</td>
</tr>
<tr>
<td>severe trauma group</td>
<td>39</td>
<td>0.85±0.19</td>
<td>2.43±0.51</td>
<td>4.16±0.78</td>
<td>3.94±0.72</td>
</tr>
<tr>
<td>critical trauma group</td>
<td>28</td>
<td>0.86±0.28</td>
<td>3.39±0.71</td>
<td>5.07±0.74</td>
<td>6.02±0.83</td>
</tr>
</tbody>
</table>

Note: ▲ compared with 0 hours in the same group P<0.05; ▲ compared with 24 h in the same group P<0.05; ▲ compared with 3 days in the same group P<0.05; ▲ compared with minor trauma group at the same time P<0.05.
<table>
<thead>
<tr>
<th>Groups</th>
<th>Cases</th>
<th>0 h</th>
<th>24 h</th>
<th>3 d</th>
<th>7 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>minor trauma group</td>
<td>31</td>
<td>49.24±22.68</td>
<td>52.43±24.54</td>
<td>50.67±24.14</td>
<td>47.87±23.18</td>
</tr>
<tr>
<td>severe trauma group</td>
<td>39</td>
<td>56.17±25.32</td>
<td>178.43±36.52</td>
<td>186.25±40.21</td>
<td>182.38±37.72</td>
</tr>
<tr>
<td>critical trauma group</td>
<td>28</td>
<td>58.06±26.45</td>
<td>225.62±58.73</td>
<td>387.48±66.42</td>
<td>402.26±68.34</td>
</tr>
</tbody>
</table>

Note: * compared with 0 h in the same group P<0.05; " compared with 24 h in the same group P<0.05; * compared with minor trauma group at the same time P<0.05.

3.2 Comparison of serum BNP levels at different stages between 3 groups patients

There were no significant differences in the levels of serum BNP on 0 h between the three groups (P>0.05); There were no significant differences in the levels of serum BNP on 0 h, 24 h, 3 d and 7 d in minor trauma group (P>0.05); The levels of serum BNP on 24 h, 3 d and 7 d were all higher than those of 0 h in severe trauma group (P<0.05); The levels of serum BNP on 24 h, 3 d and 7 d were all higher than those of 0 h in critical trauma group (P<0.05), the levels of serum BNP on 3 d and 7 d were both higher than those of 24 h (P<0.05); The levels of serum BNP in severe trauma and critical trauma groups were significantly higher compared with minor trauma group on 24 h, 3 d and 7 d (P<0.05). Table 2.

3.3 Correlation between serum Cys C levels and severity of trauma

The level of serum Cys C was correlated with the severity of trauma in 3 d of admission was performed by Pearson correlation analysis. The results showed that there was a positive correlation between the serum Cys C levels and the severity of trauma (ISS score) (r=0.912, P<0.0001).

3.4 Correlation between serum BNP levels and severity of trauma

The level of serum BNP was correlated with the severity of trauma in 3 d of admission was performed by Pearson correlation analysis. The results showed that there was a positive correlation between the serum BNP levels and the severity of trauma (ISS score) (r=0.896, P<0.0001).

4. Discussion

With the rapid development of modern society, the transportation and transportation systems are becoming more and more advanced, which makes the trauma, especially the traffic accident trauma patients, gradually increase. Traffic accident trauma has become the greatest threat to human life safety[9]. Severe trauma, in addition to blood and fluid loss, the severe pain after trauma could stimulate the excitability of the sympathetic nerve increased, result in increased catecholamine secretion. Moreover, severe trauma could also stimulate the secretion of inflammatory cytokines and release into the blood. In the early stage of trauma, inflammatory cytokines have protective effects on the body, such as regulating immune response, resisting infection and inducing apoptosis. However, with the progression of the disease, a large number of inflammatory cytokines, which mediate local and systemic inflammatory reactions, lead to the decline of immunity, which result in acute renal failure, MODS, and severe death[10,11]. How to effectively and accurately assess the trauma of trauma patients, objective assessment of the treatment of trauma patients and prognosis is of great significance.

Serum Cys C is good indicators for the evaluation of GFR. Cys C is almost entirely filtered by the glomerulus and then reabsorbed by the renal tubular epithelial cells, which is then broken down. And the renal tubules do not secrete nor excrete Cys C, so the kidneys are the only organ that clears Cys C[12]. The results of this study showed that the levels of serum Cys C increased in different degrees in patients with different degrees of trauma. Pearson correlation analysis showed that serum Cys C levels were positively correlated with the severity of trauma. It is suggested that serum Cys C levels may be important indicators of the severity of trauma.

BNP is secreted mainly by cardiac myocytes during ventricular end diastolic pressure or volume overload. By increasing the glomerular filtration rate, inhibiting the renin angiotensin aldosterone system, inhibiting sympathetic activity, and relaxing a series of vascular adjustments, BNP could reduce the preload and afterload of the heart. At present, BNP detection is mainly used in the diagnosis of cardiac failure, acute myocardial infarction and other cardiovascular diseases, differential diagnosis, prognosis evaluation, efficacy evaluation and so on[13]. In this study, BNP was associated with trauma patients. The results showed that the levels of serum BNP increased in different degrees in patients with different degrees of trauma. Pearson correlation analysis showed that serum BNP levels were positively correlated with the severity of trauma. It is suggested that serum BNP levels may be important indicators of the severity of trauma.

In summary, the levels of serum Cys C and BNP increased in different degrees in patients with different degrees of trauma. Pearson
correlation analysis showed that serum Cys C and BNP levels were positively correlated with the severity of trauma. It is suggested that serum Cys C and BNP levels may be important indicators of the severity of trauma, which could provide important reference value for clinical evaluation of trauma severity. However, this study still has some shortages, such as a relatively small sample may affect the results, not to further elucidate the mechanism of serum Cys C and BNP levels, which remains to be studied for further multi-center and more in-depth.

Reference


