Changes and significance of serum inflammatory factors, UA, Hcy and small dense low-density lipoprotein levels in patients with coronary heart disease

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OBJECTIVE: To investigate the changes and significance of serum inflammatory factors, uric acid (UA), homocysteine (Hcy) and small dense low-density lipoprotein (sdLDL-C) levels in patients with coronary heart disease (CHD). METHODS: A total of 152 patients with CHD were selected as the CHD group, including stable angina pectoris (SAP group, n=48), unstable angina pectoris (UAP group, n=55), and acute myocardial infarction (AMI group, n=49), according to the Gensinis score, it can be divided into mild group (n=88), moderate group (n=43) and severe group (n=21), at the same time 55 healthy people were selected as control group. The serum inflammatory factors [hypersensitivity C reactive protein (hs-CRP), tumor necrosis factor - α (TNF- α)], UA, Hcy and sdLDL-C levels were compared between patients with different CHD and different degree of coronary artery lesions. RESULTS: The levels of hs-CRP, TNF-, UA, Hcy and sdLDL-C in the CHD group were significantly higher than those in the control group; In the CHD group, the levels of hs-CRP, TNF- α, UA, Hcy and sdLDL-C in the UAP group and AMI group were significantly higher than those off the SAP group, and the level of AMI group [(7.96±1.49) mg/L, (92.87±14.50) ng/L, (417.75±43.88) mol/L, (23.25±7.33) and (1.31±0.53) mmol/L] was significantly higher than that of UAP group [(6.15±0.97) mg/L, (73.88±9.27) ng/L, (393.63±68.29) mol/L, (19.67±7.26) mol/L and (1.08±0.44) mmol/L]; Compared with mild group hs-CRP, TNF- α, UA, Hcy and sdLDL-C levels, the levels of the moderate group and severe group were significantly increased, and the level of severe group was significantly higher than that of moderate group. CONCLUSION: The levels of serum inflammatory factors, UA, Hcy and sdLDL-C in patients with coronary heart disease are significantly increased, and the detection of the levels has a great significance for the diagnosis of coronary heart disease and the assessment of the severity of coronary heart disease.

1. Introduction

Coronary heart disease (CHD) is a common cardiovascular disease, and atherosclerosis is the main pathological basis. In addition to high blood sugar, high cholesterol and high blood pressure and other factors, inflammatory factors also play an important role in the development of atherosclerosis[1,2]. Studies have shown that inflammation is closely related to cardiovascular events[3]. Uric acid (UA) may reflect the extent of oxidative stress in coronary arteries to a certain extent, and it may be another independent risk factor for coronary heart disease[4]. Homocysteine (Hcy) and small dense low-density lipoprotein (sdLDL-C) are important risk factors for atherosclerosis[5]. The purpose of this study was to investigate the relationship between the biochemical changes and the severity of coronary artery lesions in patients with CHD.

2. Data and methods

2.1. Data

A total of 152 patients with CHD treated in our hospital from February 2016 to June 2017 were selected as the research objects, and they were set up as CHD group. All patients were confirmed...
by clinical examination, which met the diagnostic criteria of coronary artery disease[6]. There were 48 patients with stable angina pectoris (SAP group), 55 patients with unstable angina pectoris (UAP group), and 49 patients with acute myocardial infarction (AMI group). In the SAP group, there were 29 male patients and 19 female patients, aged from 45 to 76 years. UAP group has 34 male patients, 21 cases female patients, aged from 43 to 77 years old. There were 27 male patients and 22 female patients in the AMI group, aged from 45 to 77 years. According to the modified Gensinis method[7] (the degree of coronary artery disease), they can be divided into mild group (Gensinis score <5, 88 cases), moderate group (Gensinis score 5-10, 43 cases), severe group (Gensinis score >10, 21 cases). In the same period, another healthy person who came to the hospital as the control group (55 cases), including 35 males and 20 females, aged 42-77 years. All of them were excluded: (1) severe trauma or infection, connective tissue disease, heart valve disease, malignant tumor and so on; (2) Those with an intolerance of coronary angiography; (3) Patients who are receiving or receiving lipid-lowering medications recently; (4) Reluctant to participate in the research. There was no significant difference in gender and age between the groups (P>0.05). The research accords with the standard of hospital ethics committee and has been approved by the ethical committee of our hospital, and all the patients have informed consent.

2.2. Index detection

All subjects were taken 5 mL of peripheral venous blood from early morning fasting, and serum was taken after water bath and centrifugation for testing. The serum was stored at -80 °C low temperature refrigerator for testing. The indexes included (1) inflammatory factors: high sensitivity C reactive protein (hs-CRP), tumor necrosis factor (TNF-α), were detected by radioimmunoassay and ELISA method (ELISA kit from Shanghai Biological Technology Co., Ltd.); (2) UA with Hitachi 7600 automatic biochemical analyzer, detection kit provided by Wuhan boshide Biological Engineering Co. Ltd.; (3) Hcy was detected by cyclic enzyme test, and the kit was provided by Shanghai Xian Sheng biological technology co.; (4) sdLDL-C with Hitachi 7600 automatic biochemical analyzer (detection kit from Sichuan Shenggong Technology Co., Ltd.).

3. Result

3.1. Comparison of inflammatory factors in patients between groups

The levels of hs-CRP and TNF-α in the CHD group were (6.17±1.13) mg/L and (77.25±10.36) ng/L, respectively, which were significantly higher than those of the control group, with statistical difference (P<0.05). In the CHD group, compared with SAP group, the hs-CRP and TNF-α levels of UAP group and AMI group were significantly increased, and AMI group [(7.96±1.49) mg/L, (92.87±14.50) ng/L] was significantly higher than that of UAP group [(6.15±0.97) mg/L, (73.88±9.27) ng/L], the difference was statistically significant (P<0.05). See Table 1 for details.

3.2 Compared the levels of UA, Hcy and sdLDL-C in each group

Compared with the control group, the levels of UA, Hcy and sdLDL-C in the CHD group increased significantly, and the difference was statistically significant (P<0.05). UA, Hcy and sdLDL-C levels of UAP group and AMI group were (393.63±68.29) μmol/L, (19.67±7.26) μmol/L, (1.08±0.44) mmol/L, (417.75±43.88) μmol/L, (23.25±7.33) mmol/L and (1.31±0.53) mmol/L, were significantly higher than that of SAP group, and AMI group was significantly higher than UAP group, the difference was statistically significant (P<0.05). See Table 2 for details.

Table 1.
Comparison of inflammatory factors in patients between groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>hs-CRP (mg/L)</th>
<th>TNF-α (ng/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>55</td>
<td>3.46±0.76</td>
<td>49.75±6.65</td>
</tr>
<tr>
<td>CHD group</td>
<td>152</td>
<td>6.17±1.13</td>
<td>77.25±10.36</td>
</tr>
<tr>
<td>SAP group</td>
<td>48</td>
<td>4.84±2.18</td>
<td>58.37±7.48</td>
</tr>
<tr>
<td>UAP group</td>
<td>55</td>
<td>6.15±0.97</td>
<td>73.88±9.27</td>
</tr>
<tr>
<td>AMI group</td>
<td>49</td>
<td>7.96±1.49</td>
<td>92.87±14.50</td>
</tr>
</tbody>
</table>

Note: a is compared with the control group, b is compared with group SAP, and c is UAP group comparison, statistical analysis shows P<0.05.

Table 2.
Comparison of UA, Hcy and sdLDL-C.

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>UA (μmol/L)</th>
<th>Hcy (μmol/L)</th>
<th>sdLDL-C (mmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>55</td>
<td>328.51±53.37</td>
<td>10.48±2.14</td>
<td>0.59±0.31</td>
</tr>
<tr>
<td>CHD group</td>
<td>152</td>
<td>395.49±66.28</td>
<td>19.47±7.49</td>
<td>1.12±0.49</td>
</tr>
<tr>
<td>SAP group</td>
<td>48</td>
<td>357.49±61.17</td>
<td>15.34±6.93</td>
<td>0.79±0.46</td>
</tr>
<tr>
<td>UAP group</td>
<td>55</td>
<td>393.63±68.29</td>
<td>19.67±7.26</td>
<td>1.08±0.44</td>
</tr>
<tr>
<td>AMI group</td>
<td>49</td>
<td>417.75±43.88</td>
<td>23.25±7.33</td>
<td>1.31±0.53</td>
</tr>
</tbody>
</table>

Note: a is compared with the control group, b is compared with group SAP, and c is UAP group comparison, statistical analysis shows P<0.05.
Table 3.
Compared the inflammatory factors levels in different degree of coronary artery lesions.

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>hs-CRP (mg/L)</th>
<th>TNF-α (ng/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild group</td>
<td>88</td>
<td>4.85±1.72</td>
<td>44.46±13.14</td>
</tr>
<tr>
<td>Moderate group</td>
<td>43</td>
<td>9.51±3.16</td>
<td>74.59±18.49</td>
</tr>
<tr>
<td>Severe group</td>
<td>21</td>
<td>12.44±4.68</td>
<td>96.61±29.78</td>
</tr>
</tbody>
</table>

Note: compared with the mild group, $P<0.05$; compared with the moderate group, $P<0.05$.

Table 4.
Compared the levels of UA, Hcy and sdLDL-C in different degree of coronary artery lesions.

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>UA (μmol/L)</th>
<th>Hcy (μmol/L)</th>
<th>sdLDL-C (mmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild group</td>
<td>88</td>
<td>325.97±68.09</td>
<td>13.03±4.19</td>
<td>1.07±0.39</td>
</tr>
<tr>
<td>Moderate group</td>
<td>43</td>
<td>381.18±81.46</td>
<td>17.08±5.73</td>
<td>1.37±0.57</td>
</tr>
<tr>
<td>Severe group</td>
<td>21</td>
<td>436.01±94.03</td>
<td>21.75±6.36</td>
<td>1.86±0.82</td>
</tr>
</tbody>
</table>

Note: compared with the mild group, $P<0.05$; compared with the moderate group, $P<0.05$.

3.3 Compared the inflammatory factors levels in different degree of coronary artery lesions

Hs-CRP and TNF-α levels were detected in different coronary artery lesions, and the results were shown in Table 3. Compared with mild group, moderate group [(9.51±3.16) mg/L, (74.59±18.49) ng/L], and severe group [(12.44±4.68) mg/L, (96.61±29.78) ng/L] were significantly increased, and the severe group was significantly higher than moderate group, the difference was statistically significant ($P<0.05$).

3.4 Compared the levels of UA, Hcy and sdLDL-C in different degree of coronary artery lesions

The levels of UA, Hcy and sdLDL-C were detected in different degree of coronary artery lesions and the results were shown in table 4. UA, Hcy and sdLDL-C levels of moderate group were (381.18±81.46) μmol/L, (17.08±5.73) μmol/L, and (1.37±0.57) mmol/L, which were significantly higher than those in mild group, the difference was statistically significant ($P<0.05$). In the severe group, the three levels were (436.01±94.03) μmol/L, (21.75±6.36) μmol/L, and (1.86±0.82) mmol/L, significantly higher than the mild group, and significantly higher than the moderate group, the difference was significant ($P<0.05$).

4. Discussion

CHD is also known as coronary artery disease and ischemic heart disease. It is caused by coronary atherosclerotic stenosis or blockage and causes myocardial hypoxia and ischemia[8]. CHD is more common in the middle-aged and elderly population, and the clinical symptoms are mostly arrhythmia. In developed countries, CHD is one of the most common fatal heart diseases. In China, the incidence of CHD is becoming more and more serious with the aging of the population, which seriously threatens the quality of life and health of the patients[9]. The specific pathological mechanism of the disease is still unclear, but many scholars generally believe that age, diabetes, hypertension, dyslipidemia and smoking are closely related to CHD[10-12]. The purpose of this study was to investigate the changes and significance of serum inflammatory factors, UA, Hcy and sdLDL-C levels in patients with CHD.

A large number of studies have confirmed that chronic inflammatory response and thrombosis are important factors in the formation of coronary atherosclerotic plaques, plaque progression and instability[13]. Hs-CRP is an important acute phase response protein, and its level changes reflect the inflammatory state of the organism. High level of hs-CRP can activate complement and lead to immune damage. As a bioactive cytokine, its level detection is of great value[14]. Related studies have shown that the risk of myocardial infarction increases by 3 times in patients with high levels of hs-CRP[15]. TNF-α is a common proinflammatory factor in inflammatory reactions. It has many biological activities and can promote the formation of thrombus precursors[16]. The results of this study indicate that, compared with healthy controls, serum hs-CRP and TNF-α levels in patients with CHD are significantly higher. With the severity of the disease increased, the level of ascension is more significant. The results showed that inflammatory factors were the risk factors of CHD, and the level of the inflammatory factors was significantly correlated with the severity of coronary artery lesions.

High level of UA can promote lipid peroxidation, raise oxygen free radical level, and participate in chronic inflammatory reaction, damage vascular endothelium, promote thrombosis, and then participate in the development of CHD[17,18]. Related studies have pointed out that elevated UA levels are often associated with hypertension, hyperlipidemia, and metabolic syndrome, and are closely related to cardiovascular disease[19]. Vascular endothelial injury is the initial link of coronary atherosclerosis. Hcy and sdLDL-C were caused by vascular endothelial cell injury. High homocysteine level is considered to be one of the risk factors for the occurrence and development of atherosclerosis. The higher the level of Hcy, the lower the long-term survival rate, and the prognosis of the disease is closely related[20,21]. The pathogenesis of this disease is that it can damage the adhesion of vascular endothelial cells, promote apoptosis, induce inflammatory reaction, promote the
expression of thrombomodulin and platelet aggregation, and cause the disorder of glycolipid and protein metabolism[22]. In recent years, related studies have pointed out that lipid metabolism disorder is the main manifestation of cardiovascular atherosclerosis and thrombosis. SdLDL-C is a major component of low-density lipoprotein cholesterol (LDL-C, a basic component of atherosclerotic plaques) and plays a more important role than LDL-C in atherogenesis[23,24]. The results showed that the levels of UA, Hcy and sdLDL-C in patients with coronary heart disease were significantly higher than those in the control group. In group CHD, the levels of UA, Hcy and sdLDL-C increased significantly in patients with SAP, UAP and AMI, and significantly increased with the severity of coronary artery lesions. The results of this study are consistent with the previous reports on the relationship between sdLDL-C and coronary heart disease[25].

To sum up, patients with CHD had a marked inflammatory response and had high levels of UA, Hcy, and sdLDL-C. There was a significant correlation between the level of indicators and the severity of coronary artery disease and coronary artery disease. Monitoring inflammatory factors, UA, Hcy and sdLDL-C levels have important value in understanding the patient’s condition, evaluation, treatment and prognosis.

Reference
