Effect of short-term intensive atorvastatin treatment on interventional treatment effect and cardiac function of patients with acute coronary syndrome

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ABSTRACT

Objective: To study the effect of short-term intensive atorvastatin treatment on interventional treatment effect and cardiac function of patients with acute coronary syndrome. Methods: A total of 104 cases of patients with acute coronary syndrome who received PCI treatment in Emergency Department of our hospital from May 2014 to November 2015 were retrospectively analyzed and divided into intensive group and routine group according to different atorvastatin treatment methods, and then biochemical indexes, cardiac ultrasound indicators and inflammatory indexes of two groups were compared. Results: Serum TG, TC, LDL-C, hs-CRP, LDH, α-HBDH, CK and CK-MB content of intensive group were significantly lower than those of routine group while HDL-C content was higher than that of routine group; E/A ratio and LVEF of intensive group were higher than those of routine group while Tei index, systolic index and diastolic index were lower than those of routine group; TLR4 and NF-κB expression levels in peripheral blood as well as TNF-α and IL-6 content in serum of intensive group were significantly lower than those of routine group. Conclusion: Short-term intensive atorvastatin treatment improves the interventional treatment effect of patients with acute coronary syndrome, and can reduce myocardial injury, improve cardiac diastolic and systolic function and inhibit the inflammation mediated by TLR4/NF-κB.

1. Introduction

Acute coronary syndrome (ACS) is a group of syndrome caused by coronary plaque nature change or rupture, and severe stenosis or complete occlusion of coronary artery can cause acute myocardial ischemia, thus causing the corresponding clinical symptoms. Percutaneous coronary intervention (PCI) is the preferred method in clinical treatment of ACS, which can timely recanalize coronary artery, restore myocardial blood supply and improve the prognosis of patients with ACS[1,2]. Still, the mortality of ACS patients after PCI remains high, which was associated with the complex pathogenesis of atheromatous plaque formation, nature change and plaque rupture. Current study suggests that inflammation and immune response play an important role in promoting plaque instability, and TLR4/NF-κB-mediated inflammation can cause plaque nature change[3]. Atorvastatin is a common lipid-lowering drug for clinical treatment of cardiovascular disease, and high-dose intensive atorvastatin treatment can significantly improve the prognosis of patients with cardiovascular disease[4]. In the following research, the effect of short-term intensive atorvastatin treatment on interventional treatment effect and cardiac function of patients with acute coronary syndrome was analyzed.
2. Materials and methods

2.1 Clinical information

Included cases were 104 patients with acute coronary syndrome who received PCI treatment in Emergency Department of our hospital from May 2014 to November 2015, and including criteria were as follows: (1) meeting the diagnostic criteria for acute coronary syndrome; (2) receiving emergency PCI; (3) receiving atorvastatin treatment after PCI and completing follow-up in the hospital 1 month after treatment, including peripheral blood sample collection and heart color ultrasound detection. Excluding criteria were as follows: (1) receiving thrombolytic therapy before; (2) complicated with severe liver and kidney dysfunction on admission; (3) those with malignant tumors, hematological diseases and autoimmune diseases.

2.2 Grouping methods

The cases were approved by the hospital ethics committee, retrospectively analyzed and then grouped according to different atorvastatin dose after PCI treatment, including intensive group and routine group. Intensive group received oral administration of 80 mg/night while in hospital, and oral administration of 40 mg/night after discharge; routine group received oral administration of 20 mg/night while in hospital, and oral administration of 20 mg/night after discharge.

2.3 Clinical index collection methods

4 weeks after discharge, peripheral blood was collected, then automatic biochemical analyzer was used to determine creatine kinase (CK), creatine kinase isoenzyme (CK-MB), lactate dehydrogenase (LDH), α-hydroxybutyric dehydrogenase (α-HBDH), triglyceride (TG), total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C) and high-density lipoprotein cholesterol (HDL-C) content, and flow cytometry was used to determine TLR4 and NF-κB content; enzyme-linked immunosorbent kit was used to determine TNF-α and IL-6 levels. After blood collection, cardiac ultrasound examination was conducted, frequency of the probe was 1.7-3.4 MHz, E peak and A peak were determined in apical four-chamber view and the E/A ratio was calculated, and Simpson biplane was used to calculate LVEF; left ventricular outflow track image was obtained, and isovolumetric contraction time (IVCT), ejection time (ET) and isovolumetric relaxation time (IVRT) were measured, and the Tei index, systolic index and diastolic index were calculated.

2.4 Statistical methods

SPSS 20.0 software was used to input and analyze data, measurement data between two groups was analyzed by t test, and differences were considered to be statistically significant at a level of \( P<0.05 \).

3. Results

3.1 Serum biochemical indexes

4 weeks after treatment, comparison of blood lipid indicators between two groups was shown in Table 1, which was specifically as follows: serum TG, TC and LDL-C content of intensive group were significantly lower than those of routine group while HDL-C content was higher than that of routine group; comparison of myocardial injury indicators between two groups was shown in Table 2, which was specifically as follows: serum hs-CRP, LDH, α-HBDH, CK and CK-MB content of intensive group were significantly lower than those of routine group.

<table>
<thead>
<tr>
<th>Group</th>
<th>TG (mmol/L)</th>
<th>TC (mmol/L)</th>
<th>LDL-C (mmol/L)</th>
<th>HDL-C (mmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensive</td>
<td>0.79±0.10</td>
<td>2.42±0.36</td>
<td>1.54±0.23</td>
<td>1.76±0.20</td>
</tr>
<tr>
<td>Routine</td>
<td>1.06±0.15</td>
<td>3.19±0.44</td>
<td>2.03±0.29</td>
<td>1.33±0.16</td>
</tr>
<tr>
<td>( T )</td>
<td>6.182</td>
<td>5.586</td>
<td>7.003</td>
<td>6.866</td>
</tr>
<tr>
<td>( P )</td>
<td>&lt; 0.05</td>
<td>&lt; 0.05</td>
<td>&lt; 0.05</td>
<td>&lt; 0.05</td>
</tr>
</tbody>
</table>

3.2 Ultrasonography indicators

Apical four-chamber view ultrasound and left ventricular outflow track ultrasound of two groups were compared 4 weeks after treatment, and E/A ratio, LVEF, Tei index, systolic index and diastolic index were calculated and analyzed as follows: E/A ratio and LVEF of intensive group were higher than those of routine group while Tei index, systolic index and diastolic index were lower than those of routine group, shown in Table 3.

<table>
<thead>
<tr>
<th>Group</th>
<th>Apical four-chamber view ultrasound indicators</th>
<th>Left ventricular outflow track ultrasound indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LVEF (%)</td>
<td>E/A</td>
</tr>
<tr>
<td>Intensive</td>
<td>63.58±8.91</td>
<td>1.29±0.22</td>
</tr>
<tr>
<td>Routine</td>
<td>58.75±7.44</td>
<td>1.04±0.17</td>
</tr>
<tr>
<td>( T )</td>
<td>6.283</td>
<td>5.928</td>
</tr>
<tr>
<td>( P )</td>
<td>&lt; 0.05</td>
<td>&lt; 0.05</td>
</tr>
</tbody>
</table>
3.3 Degree of inflammation

4 weeks after treatment, analysis of TLR4 and NF-κB expression levels in peripheral blood of two groups was as follows: TLR4 and NF-κB expression levels in peripheral blood of intensive group were significantly lower than those of routine group; analysis of serum TNF-α and IL-6 content of two groups was as follows: serum TNF-α and IL-6 content of intensive group were significantly lower than those of routine group.

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Degree of inflammation of two groups 4 weeks after treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>Peripheral blood samples</td>
</tr>
<tr>
<td></td>
<td>TLR4 (%)</td>
</tr>
<tr>
<td>Intensive</td>
<td>19.58±2.72</td>
</tr>
<tr>
<td>Routine</td>
<td>30.72±4.96</td>
</tr>
<tr>
<td>T</td>
<td>7.384</td>
</tr>
<tr>
<td>P</td>
<td>&lt; 0.05</td>
</tr>
</tbody>
</table>

4. Discussion

Percutaneous coronary intervention (PCI) is a common method of clinical emergency treatment of acute coronary syndrome, which can re‐canalize coronary artery and restore blood supply of ischemic myocardium. Atorvastatin is an important lipid-lowering drug for perioperative PCI, and postoperative long-term use will help to control the disease development[5]. Lipid metabolism disorder and substandard LDL-C control is an important factor that causes coronary atherosclerotic plaque nature change, and making the blood lipid level up to standard by intensive atorvastatin treatment helps to improve long-term prognosis and stabilize plaque nature in patients with ACS[6,7]. Patients’ blood lipid levels after atorvastatin treatment were compared in the research, and the results showed that serum TG, TC and LDL-C content of intensive group were lower than those of routine group while HDL-C content was higher than that of routine group. It confirmed that intensive atorvastatin treatment had better lipid-lowering effect than routine treatment.

In recent years, pharmacology research about atorvastatin believes that high-dose atorvastatin not only enhances the lipid-lowering effect, but also inhibits inflammatory response. Clinical study of domestic Sun Lina[8] confirms that intensive atorvastatin treatment can significantly reduce serum C-reactive protein (CRP) levels in ACS patients after PCI treatment. Serum CRP content has good consistency with the degree of inflammatory response, and combined with the study of study of Sun Lina, it was believed that intensive atorvastatin treatment could inhibit the degree of inflammatory response in the course of patients with ACS. Inflammation is a major change throughout various pathological processes of acute coronary syndrome, the formation of plaque, the change of nature, the rupture of the fibrous cap and the formation of thrombus are all involved in the activation of inflammatory response, and inhibiting inflammatory response has obvious significance in reducing the severity of coronary artery lesion and improving cardiac function[9,10]. Serum cardiac function-related biochemical indexes were compared between two groups after treatment in the research, and results showed that serum hs-CRP, LDH, α-HBDH, CK and CK-MB content of intensive group were significantly lower than those of routine group. It indicated that intensive atorvastatin treatment helped to reduce myocardial injury in ACS patients after PCI treatment and could also inhibit the degree of inflammatory response.

Left ventricular ejection fraction (LVEF) and E/A ratio determined by conventional echocardiogram can reflect the left ventricular systolic and diastolic function, but under the influence of geometry change after myocardial tissue ischemia, there is certain one-sidedness of LVEF and E/A for assessment of cardiac function in patients with ACS. Tei index as well as systolic index and diastolic index are newly developed indexes for cardiac function evaluation in recent years, the calculation of above indexes is not dependent on ventricular geometry and high-quality two-dimensional ultrasound images, and they are more accurate for assessment of the cardiac function in patients with ACS[11]. In the research, the recovery of cardiac function in patients with ACS was evaluated through ultrasound after interventional treatment, and analysis results of related indexes showed that E/A ratio and LVEF of intensive group were higher than those of routine group while Tei index, systolic index and diastolic index were lower than those of routine group. This meant that short-term intensive atorvastatin treatment of ACS patients after interventional therapy could significantly improve the diastolic and systolic function of the heart.

Inflammatory response in illness change process of ACS patients is mediated by a variety of inflammatory factors, massive expression and generation of inflammatory factors is regulated by complex biological mechanisms. Toll-like receptors (TLRs) are a type of pattern recognition receptors that mediate innate immune response and inflammatory reaction, and TLR4 is reported to be associated with the occurrence and progression of myocardial infarction, cerebral infarction and other cardiovascular diseases[12–15]. TLR4 downstream signaling pathway that mediates inflammatory response is mainly MyD88-dependent way, it, through MyD88, activates nuclear transcription factor NF-κB, and the latter translocates into the nucleus and starts the expression of TNF-α, IL-6 and other inflammatory cytokines[16,17]. In the research, the degree of inflammation was analyzed after atorvastatin treatment, and the results showed that TLR4 and NF-κB expression levels in peripheral blood as well as TNF-α and IL-6 content in serum of intensive group were significantly lower than those of routine group. That meant that intensive atorvastatin treatment could inhibit the TLR4/NF-κB pathway to reduce the degree of inflammation and
decrease the secretion of inflammatory cytokines in ACS patients after PCI treatment.

To sum up, short-term intensive atorvastatin treatment improves the interventional treatment effect of patients with acute coronary syndrome, and can reduce myocardial injury, improve cardiac diastolic and systolic function and inhibit the inflammation mediated by TLR4/NF-κB.

References


