Effect of rosuvastatin on inflammatory factor, oxidative stress and cardiac function in patients with chronic heart failure

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Objective: To explore effect of rosuvastatin on inflammatory factor, oxidative stress and cardiac function in patients with chronic heart failure.

Method: A total of 200 cases of patients with chronic heart failure who were admitted in our hospital from July 2015 to December 2016 and were divided randomly into observation group 100 cases and control group 100 cases, both groups patients were given conventional treatment of chronic heart failure, observation group was given rosuvastatin on this basis. Compared interleukin-6 (IL-6), tumor necrosis factor-α (TNF-α), hypersensitivity-C reaction protein (hs-CRP), superoxidedismutase (SOD), malondialdehyde (MDA) and cardiac function before and after treatment in two groups.

Results: IL-6, TNF-α, hs-CRP level after treatment was lower than before treatment in observation group and after treatment in control group. The difference was significant; IL-6, TNF-α, hs-CRP level after treatment was no significant difference with before treatment in control group. SOD level was (172.71±5.22) U/mL after treatment in observation group, higher than before treatment, moreover higher than after treatment in control group; MDA level was (3.99±0.31) nmol/mL after treatment in observation group, lower than before treatment, moreover lower than after treatment in control group; there was no significant difference in SOD, MDA level between before and after treatment in control group. After treatment, LVEDD, LVEDF were (52.19±1.33) mm, (36.33±2.82) mm, (59.88±1.62) mm, (42.41±3.43) mm in both groups, all was lower than before treatment, and observation group was lower than control group, there was statistical significant difference; LVEF of two groups was (49.90±6.26)%, (42.72±5.14)% respectively after treatment, higher than before treatment, and observation group was higher than control group, there was statistical significant difference.

Conclusion: Rosuvastatin was able to inhibit inflammatory factor, oxidative stress, moreover improved cardiac function in patients with chronic heart failure.

1. Introduction

Chronic heart failure was terminal stage clinical syndrome that all kinds of cardiovascular disease developed to the most serious stage, which ventricular blood ejection and filling function was severely decreased, threatened badly patients life[1-3]. The related research revealed that inflammatory factors and oxidative stress could promote reconstruction of cardiac muscle, which was key factor that fastened heart failure and aggravated damage of cardiac function[4-6]. As a kind of common statins drug, rosuvastatin was widely applied to clinical treatment of cardiovascular disease, not only could good lipid-lowering function, but have anti-inflammatory and anti-oxidant function[7]. This research used rosuvastatin to treat patients with chronic heart failure and observed effect on inflammatory factor, oxidative stress and cardiac function, reported as following.

2. Data and method

2.1. General data

Selected 200 cases of patients with chronic heart failure who were admitted in Wuxi people hospital from July 2015 to December 2016 as research object, diagnosis was according to 'The standard
of diagnosis and treatment of Chinese chronic heart failure\cite{8}, in the meanwhile, excluded patients who are combined acute myocardial infarction, severe infection, liver and renal dysfunction, immune system disease, took statins drugs in two months and contraindication of statins. Divided patients into observation and control group (each group was 100 cases) according to random number table. In observation group, 55 males, 45 females; aged from 43 to 74 years old; basic disease including 18 case of dilated cardiomyopathy, 27 cases of hypertensive heart disease, 38 cases coronary heart disease, 17 cases of rheumatic heart disease. In control group, 53 males, 47 females; aged from 42 to 73 years old; base disease including 18 case of dilated cardiomyopathy, 25 cases of hypertensive heart disease, 40 cases coronary heart disease, 17 cases of rheumatic heart disease. There was no obvious difference in age, gender and basic disease and other clinical data (P>0.05).

2.2. Treatment method

Both group patients were given conventional drug treatment, the common drugs including: diuretic, angiotension converting enzyme inhibitor, β-receptor retardant, digitalis, and kept sufficient rest, proper sport, gave up smoking and drinking, limited sodium salt and other supporting therapy. Observation group was given rosuvastatin (Produced by AstraZeneca Pharmaceutical Co. Ltd, Approval number: Registration number: J20090092), One time/day, 10 mg/time. Continuous treatment was for 6 months of both groups.

2.3. Observation index

Collected fasting venous blood of patients in both groups before and after treatment, centrifuged 3 000 r/min, and separated serum after 10 min, stocked at -80 °C freezer for detection. Interleukin-6 (IL-6), tumor necrosis factor-α (TNF-α) was measured by enzyme-linked immunosorbent assay, used immune project nephelometer to detect hypersensitivity-C reaction protein (hs-CRP); Misra Hp photochemical amplification method was applied for detecting superoxidemutase (SOD), thiobarbituric acid colorimetric method was used to measured malondialdehyde (MDA).

Detected cardiac function in both groups before and after treatment, including left ventricular end diastolic diameter (LVEDD), left ventricular end systolic diameter (LVESD) and left ventricular ejection fraction (LVEF) measured by USA IE-33 PHILIPS Echocardiogram and Color Doppler Ultrasonic cardiogram.

2.4 Statistical method

The software SPSS 19.0 was used for all data analysis, measurement data was showed by (x±s), independent-samples t-test was applied to interblock comparison; pared-samples t-test was used for intra-group comparison. P<0.05 indicated the difference was statistical significant.

3. Results

3.1. Comparison of inflammatory factor in two groups

There was no significant difference in serum inflammatory factors IL-6, TNF-α and hs-CRP levels in two groups before treatment (P>0.05), IL-6, TNF-α, hs-CRP levels in observation group after treatment were (6.25±1.41) ng/L, (2.14±0.32) ng/L, (15.03±5.02) mg/L respectively, lower than before treatment and after treatment in control group. The difference was significant (P<0.05); IL-6, TNF-α , hs-CRP levels in control group were (9.07±2.19) ng/L, (5.14±1.10) mg/L, there was no significant difference with before treatment in control group (P>0.05). Seeing Table 1.

### Table 1.
Comparison of inflammatory factor in two groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Time</th>
<th>IL-6 (ng/L)</th>
<th>TNF-α (ng/L)</th>
<th>hs-CRP (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation group</td>
<td>49</td>
<td>Before</td>
<td>9.14±2.06</td>
<td>5.05±0.93</td>
<td>36.02±6.14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>After</td>
<td>6.25±1.41</td>
<td>2.14±0.32</td>
<td>15.03±5.02</td>
</tr>
<tr>
<td>Control group</td>
<td>49</td>
<td>Before</td>
<td>9.17±2.12</td>
<td>5.13±1.01</td>
<td>35.73±5.93</td>
</tr>
<tr>
<td></td>
<td></td>
<td>treatment</td>
<td>9.07±2.19</td>
<td>5.14±1.10</td>
<td>33.76±5.56</td>
</tr>
</tbody>
</table>

Note: Compared with before treatment, *P*<0.05; compared with control group after treatment, †*P*<0.05.

3.2. Comparison of oxidative stress in both groups

There was no significant difference in SOD, MDA level in both groups before treatment (P>0.05). The software SPSS 19.0 was used for all data analysis, measurement data was showed by (x±s), independent-samples t-test was applied to interblock comparison; pared-samples t-test was used for intra-group comparison. P<0.05 indicated the difference was statistical significant.

### Table 2.
Comparison of oxidative stress in both groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Time</th>
<th>SOD (U/mL)</th>
<th>MDA (nmol/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation group</td>
<td>49</td>
<td>Before</td>
<td>95.18±5.13</td>
<td>8.19±0.52</td>
</tr>
<tr>
<td></td>
<td></td>
<td>treatment</td>
<td>172.71±5.22</td>
<td>3.99±0.31</td>
</tr>
<tr>
<td>Control group</td>
<td>49</td>
<td>Before</td>
<td>92.33±3.83</td>
<td>7.78±0.44</td>
</tr>
<tr>
<td></td>
<td></td>
<td>treatment</td>
<td>99.29±4.64</td>
<td>7.13±0.52</td>
</tr>
</tbody>
</table>

Note: Compared with before treatment, *P*<0.05; compared with control group after treatment, †*P*<0.05.
mL after treatment in observation group, higher than before treatment ($P<0.05$), moreover higher than after treatment in control group ($P<0.05$); MDA level was (3.99±0.31) nmol/mL after treatment in observation group, lower than before treatment ($P<0.05$), moreover lower than after treatment in control group ($P<0.05$); The SOD, MDA level was (99.29±4.64) U/mL,(7.13±0.52) nmol/mL respectively after treatment in control group, there was no difference compared with before treatment ($P>0.05$). Shown in Table 2.

### 3.3. Comparison of cardiac function in both groups

There was no difference in LVEDD, LVEDF, LVEF level in both groups before treatment ($P>0.05$). After treatment, LVEDD, LVEDF were (52.19±1.33) mm, (36.33±2.82) mm, (59.88±1.62) mm, (42.41±3.43) mm in both groups, all was lower than before treatment, and observation group was lower than control group, there was statistical significant difference ($P<0.05$); LVEF of both groups were (49.90±6.26)%,(42.72±5.14)% respectively after treatment, higher than before treatment, and observation group was higher than control group, there was statistical significant difference ($P<0.05$).

### 4. Discussion

Chronic heart failure was resulted from myocardial function and tissue change that was due to continuous progress of initial myocardial damage, with periphery blood abnormal distribution, activated neuroendocrine, excessive release of cytokines in the same time, eventually resulted in severe damage of ventricular blood ejection and filling function[9-12]. In recent, with aging of people, trend of cardiovascular disease occurrence was increasing severe, as terminal stage of variable cardiovascular diseases, morbidity of chronic heart failure was increased by years, according to statistics, morbidity of chronic heart failure disease in aging population was close to 30%[3]. Therefore, reasonable and effective drug treatment was important to decrease heart damage and rescue patients’ life. Related research demonstrated that inflammatory factors and oxidative stress could promote reconstruction of cardiac muscle, which was key factor that fastened heart failure and aggravated damage of cardiac function[13,14]. Under chronic activation of inflammatory factors in patients with chronic heart failure, body produced mass of TNF-α and engaged in the reconstruction of ventricle, meanwhile, released a lot of IL-6 which not only could aggravated inflammatory reaction, but promoted cardiac hypertrophy, then participated in myocardial remodeling. Production of IL-6 further induced hs-CRP release, sharpened inflammatory reaction through complement system, damaged myocardial cells and destroyed cardiac function [15-17]. Oxidative stress led to free radical released largely, then damaged vascular endothelial, resulted in myocardial ischemia and anoxia. SOD was important antioxidase, higher activity presenting the stronger ability that eliminated free radical[18]. MDA was able to trigger oxidation reaction, the variation of content could represented the variation of free radical[19]. SOD and MDA could reflect degree of oxidative reaction synthetically. This research results revealed that IL-6, TNF-α, hs-CRP levels after treatment in observation group were (6.25±1.41) ng/L, (2.14±0.32) ng/L, (15.03±5.02) mg/L, lower than before treatment ($P<0.05$), moreover lower than control group after treatment ($P<0.05$); SOD level was (172.71±5.22) U/mL after treatment in observation group, higher than before treatment ($P<0.05$), moreover higher than after treatment in control group ($P<0.05$); MDA level was (3.99±0.31) nmol/mL after treatment in observation group, lower than before treatment ($P<0.05$), moreover lower than after treatment in control group ($P<0.05$). Above results indicated that rosuvastatin was able to inhibit effectively inflammatory factors, oxidative stress, this was conformed to the results of Guo Liying et al[20]. The reason might be statins drug could lower inflammation, inhibit lipid peroxidation and oxidative stress, however, conventional treatment was no obvious improvement to inflammation and oxidative stress.

This research also found that after treatment LVEDD, LVEDF were (52.19±1.33) mm, (36.33±2.82) mm, (59.88±1.62) mm, (42.41±3.43) mm in both groups, all was lower than before treatment ($P<0.05$), decreased range of observation group was larger than control group ($P<0.05$), there was statistical significant difference ($P<0.05$); LVEF of both groups were (49.90±6.26)%, (42.72±5.14)% respectively after treatment, higher than before treatment, and increased range of observation group was higher than control group ($P<0.05$). This demonstrated that effect of rosuvastatin that improved cardiac function was more significant. Analyzed that reason, mainly due to rosuvastatin was capable of inhibiting inflammatory factors IL-6, TNF-α, hs-CRP, decreased degree of oxidative stress, then prevented myocardial remodeling, hindered the development of chronic heart failure by pathological mechanism, thereby improved contractility of myocardial cells, enhanced cardiac function[7,21].
In conclusion, rosuvastatin was capable of inhibiting effectively inflammatory factors and oxidative stress, moreover improved cardiac function, it was worthy of clinical application.

Reference


