Correlation of ultrasound detection of carotid atherosclerosis plaque with ischemic cerebral stroke

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Objective: To explore the correlation of ultrasound detection of carotid atherosclerosis (CAS) plaque with ischemic cerebral stroke. Methods: A total of 120 patients with ischemic cerebral stroke who were admitted in our hospital from April, 2015 to April, 2016 were served as the observation group, while 120 patients with CAS plaque but no cerebral stroke were served as the control group. The color Doppler ultrasonic diagnosis apparatus was used to detect the stenosis degree and blood flow volume of CCA, ICA, and VA. The two-dimensional ultrasound was used to measure IMT and plaque score. Results: The ratio of unstable plaques in the observation group was significantly higher than that in the control group (P<0.05). IMT and plaque area in the observation group were significantly greater than those in the control group (P<0.05). The stenosis degree of CCA, ICA, and VA in the observation group was significantly higher than that in the control group (P<0.05). The blood flow volume of CCA, ICA, and VA in the observation group was significantly less than that in the control group (P<0.05). Conclusions: CAS plaque is closely associated with ischemic cerebral stroke. The carotid artery color Doppler ultrasound can evaluate the intravascular plaque and stenosis degree, which can guide the corresponding treatment, and is of great significance in estimating the ischemic cerebral stroke in patients with CAS.

1. Introduction

The ischemic cerebral stroke is a main reason for disability and death in the middle-aged and elderly people, with a gradually increasing morbidity among the cardiovascular and cerebrovascular diseases, while carotid atherosclerosis (CAS) is one of the risk factors for developing ischemic cerebral stroke, and the atherosclerotic plaque stability is the most important risk factor[1,2]. CAS is one manifestation of systemic arteriosclerosis, is a pathological process with chronic and degenerative inflammation of great arteries, and can reflect the intracranial atherosclerosis to a certain degree; therefore, it is argued that CAS is closely associated with ischemic cerebral stroke[3]. The carotid ultrasound can reflect an early atherosclerosis to a certain degree; therefore, it has been an early observation indicator for studying the risk factors of cardiovascular and cerebrovascular diseases[4]. The study is aimed to explore the correlation of ultrasound detection of CAS plaque with ischemic cerebral stroke in order to provide an evidence for the prevention of ischemic cerebral stroke.

2. Materials and methods

2.1. General materials

A total of 120 patients (cardiogenic patients and cerebral stroke patients underwent surgery and endovascular treatments excluded) with ischemic cerebral stroke who were admitted in our hospital from April, 2015 to April, 2016 were served as the observation group, among which 72 were male, and 48 were female; aged from 52 to 83 years old, with an average age of (69.3±7.8) years old. Moreover, 120 patients with CAS plaque but no cerebral strokes
were served as the control group, among which 69 were male, and 51 were female; aged from 53 to 83 years old, with an average age of (68.7±7.5) years old. The comparison of age and gender between the two groups was not statistically significant (P>0.05).

2.2. Methods

The color Doppler ultrasound was adopted. A supine position was taken to fully expose the neck, and the neck was slightly turning to the contralateral side. CCA, ICA, and VA were detected in a rest state. The two-dimensional ultrasound was used to measure IMT and plaque area. The plaque morphology, margin, and echo were observed. The ultrasound high fine blood flow technology was used to detect the micro new blood vessels inside the plaques in order to estimate the stability of plaques. The plaque score was evaluated by Crouse. The carotid atherosclerosis degree was estimate. Meanwhile, the vascular wall stenosis degree and hemodynamic change were measured.

2.3. Statistical analysis

SPSS 19.0 software was used for the statistical analysis. The measurement data were expressed as mean±SD, and t test was used. Chi-square test was used for the enumeration data. P<0.05 was regarded as statistically significant difference.

3. Results

3.1. Comparison of plaque stability between two groups

In the observation group, 35 (29.2%) had stable plaques, and 85 (70.8%) had unstable plaques. In the control group, 79 (65.8%) had stable plaques, and 41 (34.2%) had unstable plaques. The ratio of unstable plaques in the observation group was significantly higher than that in the control group (P<0.05).

3.2. Comparison of IMT and plaque area between two groups

IMT and plaque area in the observation group were significantly greater than those in the control group (P<0.05) (Table 1).

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>IMT (mm)</th>
<th>Plaque area (mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>120</td>
<td>0.95±0.27</td>
<td>1.68±0.77</td>
</tr>
<tr>
<td>Control</td>
<td>120</td>
<td>0.79±0.52</td>
<td>0.27±0.15</td>
</tr>
</tbody>
</table>

P<0.05, when compared with the control group.

3.3. Comparison of CAS stenosis degree between two groups

The stenosis degree of CCA, ICA, and VA in the observation group was significantly higher than that in the control group (P<0.05) (Table 2).

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>CCA</th>
<th>ICA</th>
<th>VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>120</td>
<td>32.41±0.33</td>
<td>45.85±0.68</td>
<td>6.35±0.21</td>
</tr>
<tr>
<td>Control</td>
<td>120</td>
<td>14.52±0.57</td>
<td>19.32±0.50</td>
<td>0</td>
</tr>
</tbody>
</table>

P<0.05, when compared with the control group.

3.4. Comparison of carotid and cerebral blood flow volume between two groups

The blood flow volume of CCA, ICA, and VA in the observation group was significantly less than that in the control group (P<0.05) (Table 3).

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>CCA</th>
<th>ICA</th>
<th>VA</th>
<th>Brain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>120</td>
<td>268.45±91.33</td>
<td>89.45±31.57</td>
<td>58.87±32.45</td>
<td>293.41±89.65</td>
</tr>
<tr>
<td>Control</td>
<td>120</td>
<td>387.71±85.46</td>
<td>195.78±58.69</td>
<td>78.15±25.31</td>
<td>553.82±58.74</td>
</tr>
</tbody>
</table>

P<0.05, when compared with the control group.

4. Discussion

The ischemic cerebral stroke is a common disease in the clinic, and is caused by hemodynamic change or thrombus arising from carotid stenosis due to CAS plaque, characterized by urgent onset and rapid progression, which is a main reason for death; therefore, early diagnosis and positive treatments should be taken to reduce the occurrence of ischemic cerebral stroke and decrease the disability rate and death rate[5,6]. In the actual clinical practice, only a small amount of cerebra stroke patients can obtain thrombolysis 3 h after attack which can improve the condition through revascularization, and can achieve a better outcome, but most patients will miss this time window, so that most survivors have different sequela, with a high recurrence risk; therefore, early prevention of ischemic cerebral stroke has been the focused tissue in the clinic, especially its correlation with CAS[7,8].

The mechanism of CAS for causing ischemic cerebral stroke is listed in the following: (1) the gradually increased atherosclerotic plaques directly block the blood vessels; (2) the plaque surface is coarse, and the thrombus is formed due to the activation of blood coagulation factors and blood platelet; (3) the plaques are unstable or ruptured, and the ruptured plaques block the distal blood vessels; (4) the narrow carotid artery reduces the distal vascular perfusion pressure, resulting in insufficient blood supply of watershed area,
and forming the marginal infarction or low perfusion infarction[9,10]. When there is a mild carotid stenosis, the body can reduce the peripheral vascular resistance, and expand the distal vessels to maintain the normal blood perfusion of brain tissues. If the stenosis is continuously developed, the peripheral perfusion pressure is continuously reduced, and finally a decapsulation occurs to cause low perfusion of peripheral circulation, resulting in infarction[11]; therefore, study on the correlation of CAS plaque with ischemic cerebral stroke is of great significance in early detecting CAS plaque and preventing the ischemic cerebral stroke.

The ultrasound is a main examination method for the diagnosis of arterial diseases in the clinic, in that in can definitely detect the artery intima-media, and can confirm the atherosclerotic plaque, stenosis degree[12], and hemodynamic change. Due to the superficial carotid artery and the noninvasiveness of ultrasound examination, the interference is small. The pathomorphological change of atherosclerosis can reflect the intracranial vascular change, and can provide an important evidence for the cerebral stroke patients, among which IMT is an early indicator to indirectly reflect the cerebral arteriosclerosis degree, while the atherosclerotic plaque is a risk factor for developing cerebral stroke and is of great significance in the monitoring and detection for atherosclerosis patients with no symptoms[13,14]. It is reported that adoption of carotid ultrasound for CAS patients can timely detect the atherosclerotic plaque, and measure the plaque morphology, size, and property through the extracranial cerebral artery structure change to accurately estimate the intracranial blood flow, assist in distinguishing the non-infarct cerebrovascular diseases, early discover the ischemic cerebral stroke patients, and guide the effective prevention and treatment in the clinic[15,16]. The results in the study showed that the ratio of unstable plaques in the observation group was significantly higher than that in the control group (P<0.05); IMT and plaque area in the observation group were significantly greater than those in the control group (P<0.05); the stenosis degree of CCA, ICA, and VA in the observation group was significantly greater than that in the control group (P<0.05); the blood flow volume of CCA, ICA, and VA in the observation group was significantly less than that in the control group (P<0.05), indicating that the cerebrovascular disease will not occur in all patients with carotid stenosis, while the carotid plaque is closely associated with the ischemic cerebral stroke, and is one of the main risk factors.

In conclusion, CAS plaque is closely associated with ischemic cerebral stroke. The carotid artery color Doppler ultrasound can evaluate the intravascular plaque and stenosis degree, which can guide the corresponding treatment, and is of great significance in estimating the ischemic cerebral stroke in patients with CAS.

References