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# *Carotid Plaque and Its Stability in Patients with Cerebral Infarction*

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***Abstract:*** Objective to investigate the characteristics of carotid atherosclerosis in patients with cerebral infarction and its relationship with cerebral infarction. Methods: One hundred and sixty patients with cerebral infarction were included in the study. Ultrasound examination of cervical artery was used to analyze and compare the differences of clinical data between stable and unstable plaques, including gender, hypertension, diabetes, fasting blood glucose, triglyceride (TG), cholesterol (TC), high-sensitivity C-reactive protein (hs-CRP) and low-density lipoprotein (LDL-C). Results: The number of stable plaques was more than that of unstable plaques, and the proportion of flattened plaques was the highest (30.6%) and that of mixed plaques the lowest (18.6%). The proportions of smoking, hypertension and diabetes in patients with unstable plaques were significantly higher than those in patients with stable plaques. The levels of fasting blood glucose, TG, TC, hs-CRP and LDL-C were significantly higher than those in patients with stable plaques. Logistics multivariate analysis of carotid plaque stability in patients with cerebral infarction showed that smoking, hypertension, diabetes, and hs-CRP were risk factors for carotid plaque stability in patients with cerebral infarction. Conclusion: Carotid stable plaque is the common cause of cerebral infarction, and the proportion of unstable plaque is higher. Smoking, hypertension, diabetes, and hs- CRP were the risk factors for the instability of carotid plaques.

## 1. Introduction

The incidence rate of cerebral infarction is high. It is the most common cerebrovascular disease in the middle and old aged people[1]. The patients are mostly partial sensory motor disorder, which seriously affects their quality of life and survival time. Neck and cerebrovascular diseases are the pathological basis of cerebral infarction, including arterial embolism, thrombosis and arterial spasm[2]. The blood supply of brain tissue mainly comes from internal carotid artery system and vertebrobasilar artery system. Any part of artery stenosis or occlusion will lead to insufficient or interrupted blood supply of brain tissue, resulting in hypoxia ischemia and infarction[3]. Recent studies have shown that carotid artery stenosis is an important cause of cerebral infarction, among which carotid plaque is the main cause of carotid artery stenosis, and the probability of unstable

plaque causing cerebral infarction is higher. Therefore, the evaluation of carotid plaque stability is very important to guide the treatment of patients[4]. In this study, the author analyzed the clinical data of 160 patients with acute cerebral infarction, discussed the types of carotid plaque in patients with cerebral infarction, and analyzed the related factors affecting the stability of plaque.

## 2. Data and Methods

### 2.1 General Data

One hundred and sixty patients with cerebral infarction in the Department of Neurology of our hospital from July 2019 to June 2020 were selected as the research subjects, including 98 males and 62 females, aged from 32 to 77 years old, with an average of (64.14 5.17) years old. Diagnostic criteria for cerebral infarction were in accordance with the diagnostic criteria in 2010 Guidelines for Diagnosis and Treatment of Acute Ischemic Stroke in China, and confirmed by cerebral CT or MRI scan after 24 h. All the patients were subjected to detailed neurological examination as well as ECG, chest radiography, blood pressure, liver and kidney function and routine blood tests[5]. He was asked in detail and his hypertension, diabetes mellitus, smoking and alcohol consumption history were recorded. Patients with obvious liver, kidney or heart failure, severe infection or malignant disease, potential infection signs and symptoms in the past four weeks, a history of surgery and trauma, and rheumatic heart disease were excluded.

### 2.2 Carotid Artery Ultrasound Examination

The frequency of the peripheral blood vessel probe using the US HD15000 color Doppler ultrasound diagnostic apparatus was 5-15Hz[6]. The patient was in the supine position. The common carotid artery, the carotid branch office and 2cm from the origin of the internal carotid artery were explored longitudinally and transversely, respectively[7]. The intimal medial thickness, plaque nature and the degree of lumen stenosis were observed. Intimal thickening was defined as having an IMT of 0.8 to 1.2 mm and plaques were defined as having an IMT > 1.2 mm[8]. The location of the largest plaque was determined as (1 − residual vascular cross-sectional area ÷ vascular cross-sectional area) × 100%. According to the differences in ultrasonic characteristics of carotid plaques, they were divided into stable plaques (hard plaques and flat plaques) and unstable plaques (soft plaques and mixed plaques)[9].

### 2.3 Laboratory Examinations

Three weeks after admission, 2mL elbow venous blood was drawn, the supernatant was collected by centrifugation, and the specimen was stored at − 20 C[10]. Fasting blood was taken for fasting blood glucose, total cholesterol and triglycerides. In order to avoid affecting the test results, patients in each group were not given lipid-lowering drugs except for the routine treatment of stroke 1 week before blood draw.

### 2.4 Statistical Analysis

SPSS 17.0 statistical software was used for statistical analysis. The measurement data were expressed as mean standard deviation, and for comparison, t test was used. The count data were expressed as n. $\chi 2$ test was used for statistical method and logistics multivariate analysis was used for multivariate analysis. Differences were considered to have statistical significance when the P value was less than 0.05.

## 3. Results

2.1 The types and constituent ratios of carotid plaques in patients are shown. Among the 160 patients, the number of stable plaques is more than that of unstable plaques, and the proportion of flat plaques is the highest, at 30.6%, and that of mixed plaques is the lowest, at 18.6%.See table 1.

*Table 1 Types and Constituent Ratios of Carotid Plaques in Patients*

| | | Number of cases | constituent ratio |
|---|---|---|---|
| stable plaque n=95 | Flat spot | 49 | 30.6 |
| unstable plaque n=65 | Hard spot | 46 | 28.8 |
| | Soft spot | 35 | 22.0 |
| | Mixed spot | 30 | 18.6 |

2.2 The single factor analysis of the stability of carotid plaques in patients with cerebral infarction is shown in Table 2. The proportions of smoking, hypertension and diabetes in patients with unstable plaques are significantly higher than those in patients with stable plaques. The levels of fasting blood glucose, TG, TC, hs-CRP and LDL-C are significantly higher than those in patients with stable plaques, and the difference is statistically significant ($P < 0.05$). See table 2

*Table 2 Single Factor Analysis of Carotid Plaque Stability in Patients with Cerebral Infarction*

| Factor | stable plaque | unstable plaque |
|---|---|---|
| Gender (male, case) | 45 | 53 |
| Smoking (case) | 34 | 52 |
| Hypertension (case) | 29 | 47 |
| Diabetes (case) | 21 | 32 |
| Fasting blood glucose (mmol/L) | 6.6±1.2 | 7.9±1.5 |
| TG(mmol/L) | 2.3±0.5 | 3.0±0.9 |
| TC(mmol/L) | 4.6±1.0 | 6.0±1.2 |
| Hs-CRP(mg/L) | 11.8±2.9 | 18.0±3.7 |
| LDL-C(mmol/L) | 3.6±0.5 | 4.0±0.8 |

2.3 Logistics multivariate analysis of carotid plaque stability in patients with cerebral infarction Smoking, hypertension, diabetes, hs-CRP are risk factors for the stability of carotid plaque in patients with cerebral infarction, see Table 3.

*Table 3 Multivariate Analysis Of Carotid Plaque Stability in Patients with Cerebral Infarction*

| Factor | OR | 95%CI | P |
|---|---|---|---|
| Smoking | 2.799 | 1.686-2.546 | 0.040 |
| Hypertension | 2.490 | 1.899-2.399 | 0.030 |
| Diabetes | 3.129 | 1.770-5.766 | 0.040 |
| TG | 0.680 | 0.580-2.877 | 0.068 |
| TC | 0.988 | 0.787-3.266 | 0.177 |
| Hs-CRP | 2.988 | 1.988-3.188 | 0.023 |
| LDL-C | 0.787 | 0.988-2.336 | 0.062 |

## 4. Discussion

Ischemic stroke is one of the major fatal diseases in China, and its disability rate is the first among all diseases[11]. In the past, it was considered that the vascular lesions causing arteriosclerotic cerebral infarction mainly occurred in intracranial arteries, but in recent years, studies have shown

that carotid atherosclerosis is one of the important causes for cerebral infarction. It has been reported in the literature that carotid canal's stenosis is greater than 50% in 91% of patients with focal stroke and 76% of patients with transient ischemic attack[12]. However, the incidence rate of severe carotid stenosis found in this study was only 4.17%, which was similar to the results in our previous study and other domestic studies. The incidence of cervical plaques was 2.5%[13]. This indicates that the carotid atherosclerotic lesions in patients with ischemic stroke in China may be characterized by plaques, and the incidence of severe stenosis is low. The reason is still unclear, which may be related to the large differences in the dietary structure and living habits of Chinese and European and American races.

In this study, Doppler ultrasound showed that among the 160 patients, the number of stable plaques was more than that of unstable plaques, and the proportion of flattened plaques was the highest, at 30.6%, and that of mixed plaques was the lowest, at 18.6%. These results indicated that Doppler ultrasound could diagnose and classify carotid plaques qualitatively and accurately. In this study, the factors related to the stability of carotid plaques were explored. The results showed that the specific cases of smoking, hypertension and diabetes in patients with unstable plaques were significantly higher than those in patients with stable plaques, and the levels of fasting blood glucose, TG, TC, hs-CRP and LDL-C were significantly higher than those in patients with stable plaques. The multivariate Logistics regression analysis showed that smoking, hypertension, glucosuria and hs-CRP were the risk factors affecting the stability of carotid plaques in patients with cerebral infarction. Smoking is an independent risk factor for atherosclerosis. The incidence and course severity of atherosclerosis are significantly increased in long-term smoking patients. High blood pressure and diabetes will cause decreased arterial elasticity, smooth muscle cells and fibroblasts to proliferate and absorb lipids, and intima damage will generate plaques. Severe metabolic abnormalities will lead to increased lipid deposition and increased instability. The increase of hs-CRP reflects the increase of the level of inflammatory stress response in the body, which is often accompanied by the increase of oxidative stress in the body, the increase of nitric oxide level, the aggravation of endothelial cell injury, and the increase of lipid deposition, resulting in the increase of plaque instability.

In summary, the common causes of cerebral infarction are stable carotid plaques, and the proportion of unstable plaques is higher. Smoking, hypertension, diabetes, and hs- CRP were the risk factors for the instability of carotid plaques[14].

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