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ORIGINAL ARTICLE

Correlation between serum c-reactive protein and cystatin c in patients with acute cerebral infarction and carotid artery stenosis

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Abstract: To investigate the correlation between serum C-reactive protein (CRP) and serum cystatin C (Cys-C) levels in patients with acute cerebral infarction and carotid artery stenosis. Methods: From January 2015 to December 2016 admitted to our hospital new acute cerebral infarction parallel neck vascular color doppler ultrasound examination showed 121 cases of carotid stenosis as the case group; select the same period of hospitalized patients with non-cerebrovascular disease in 50 cases as a control group. Fasting venous blood was collected on the third day after onset of the disease and serum levels of CRP and Cys-C were measured and compared. Results: Serum levels of CRP and Cys-C in case group were significantly higher than those in control group ($P < 0.05$). The correlation between serum CRP and Cys-C was found in any pairwise comparison ($r = 0.4732$). The level of CRP and Cys-C were closely related to the degree of carotid artery stenosis ($P < 0.05$). Conclusion: The combined detection of serum CRP and Cys-C levels can be used to evaluate the degree of carotid artery stenosis in patients with acute cerebral infarction and provide a reference for the next carotid endarterectomy.

Keywords: Acute cerebral infarction; carotid stenosi;, serum c-reactive protein; serum cystatin c; correlation

Atherosclerosis caused by carotid artery stenosis is the pathological basis of cerebral infarction, so the early diagnosis and treatment of carotid artery stenosis reduce the incidence of cerebral infarction, morbidity and mortality is particularly important. Studies have shown that atherosclerosis is actually a process of chronic inflammation, the development of cerebral infarction will activate the phagocytic system, mediated immune and inflammatory response[1]. Studies have shown that C-reactive protein (CRP) as a marker of inflammation involved in the formation of atherosclerosis and promote the pathophysiology of acute cerebral infarction [2], CRP levels reflect the level of brain tissue damage. Foreign scholars [3] study found that serum Cys-C is an important inflammatory marker of atherosclerosis, in addition to reflect the level of inflammatory in vivo, or an independent predictor of carotid stenosis. This study aimed to analyze the relationship between serum CRP, Cys-C and the occurrence of acute cerebral infarction associated with carotid stenosis and to explore the relationship between serum CRP, Cys-C levels and carotid artery stenosis.

1. Data and methods

1.1 Clinical data: Select the first incidence of acute cerebral infarction in line with the diagnostic criteria of 121 cases from January 2015 to December 2016 admitted to our hospital with acute cerebral infarction patients with carotid

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artery stenosis as a case group, the onset time is less than 7 days; the same period in our hospital physical examination of non-cerebrovascular disease in 50 patients as a control group. 121 patients were examined by cervical vascular ultrasound (stenosis recommended according to NASCET method), were divided into mild stenosis group, moderate stenosis group, severe stenosis group. The mean age, smoking history, body mass index (BMI), hypertension, diabetes mellitus and hyperlipemia in the four groups were statistically analyzed.

1.2 Exclusion criteria: All subjects should be ruled out with serious liver and kidney disease, acute and chronic myocardial infarction, heart failure, cancer, severe immune system diseases and infectious diseases, while excluding the influence of serum taken within 1 month Cys-C, CRP levels of drugs, such as anticoagulant drugs (aspirin), vitamin B family (folic acid), carbamazepine, immunosuppressive drugs, hormone drugs.

1.3 Determination: Patients in the case group fasting venous blood on the third day after admission, the control group of patients in the physical examination when collecting venous blood, using immunoturbidimetric determination of serum CRP and Cys-C concentrations of reagents for Ningbo Ruiyuan biological Technology Co., Ltd. products, Olympus AU2700 automatic biochemical analyzer, according to the instructions flow test specimens.

1.4 Statistical Methods: Application SPSSl8.0 software measurement data to i ± s that the use of t test and analysis of variance, count data using the chi-square test. Correlation between the two variables using correlation analysis to calculate the correlation coefficient r, and to P <O. 05 for the difference was statistically significant.

2. Result

2.1. 121 cases of acute cerebral infarction with carotid artery stenosis in patients with mild carotid stenosis 48 cases, 41 cases of moderate stenosis, severe stenosis in 32 cases. The average age, smoking history, body mass index (BMI), hypertension, diabetes mellitus, and hyperlipidemia in the four groups were not significantly different (P> 0.05). See table 1.

	Number of cases	**Average age**	**Smoking History**	**BMI**	**Hypertension**	**Diabetes**	**Hyperlipidemia**
Group		Year	n（%）	kg / m^2	n（%）	n（%）	n（%）
Control Group	50	62.3±6.5	19（38%）	25.3±6.1	24（48%）	17（34%）	20（40%）
Mild Stenosis Group	48	64.2±7.2	22(45.83%)	26.7±4.3	19（15.70%）	12（9.93%）	18（14.88%）
Moderately Strict Group	41	66.8±6.9	17(41.46%)	25.9±6.9	17（14.05%）	13(10.74%)	19（15.70%）
Severe Stenosis Group	32	65.1±7.9	14(43.75%)	26.2±5.8	14（11.57%）	11（9.09%）	15（12.40%）
P		0.11	0.08	0.06	0.07	0.13	0.09

Table 1. The general clinical characteristics of each group comparison

2.2. Acute cerebral infarction with carotid artery stenosis in patients with serum CRP levels and serum Cys-C levels were compared between any two, the values were higher than the control group, and P values were less than 0.05 level.

2.3. Acute cerebral infarction with carotid artery stenosis in patients with serum CRP and serum Cys-C correlation analysis, there is a close linear correlation between the two, the correlation coefficient r = 0.4732. see picture 1.

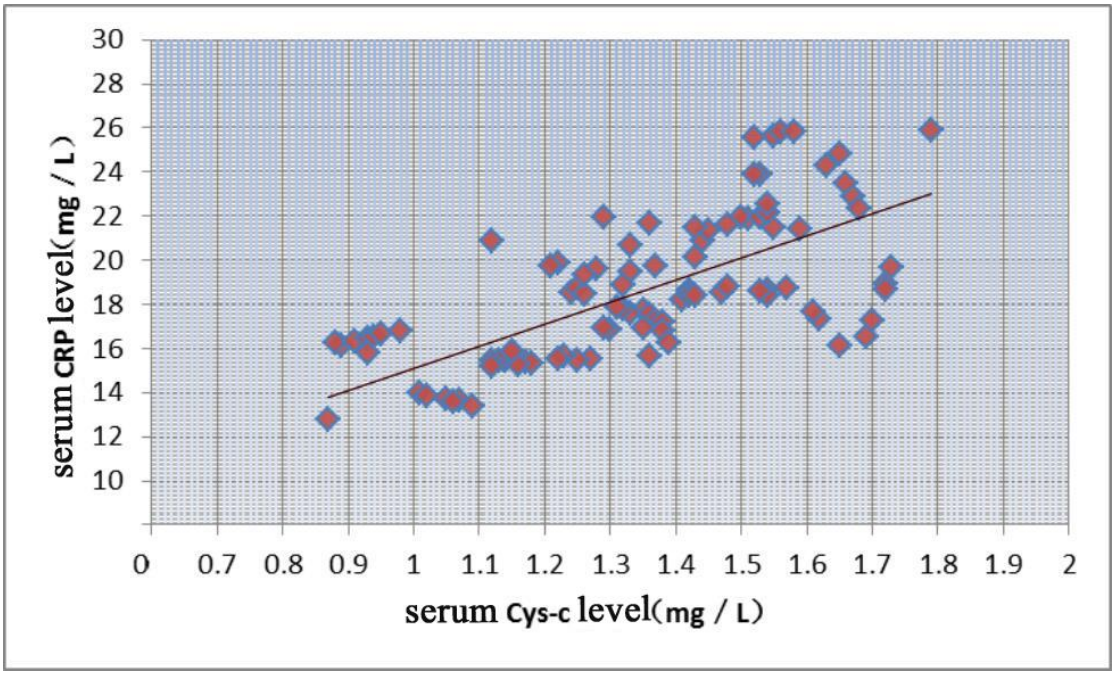

Figure 1. Correlation between serum CRP and serum Cys-C.

2.4. Serum CRP, Cys-C levels and carotid stenosis in patients with acute cerebral infarction, the comparison of any two found mild, moderate and severe carotid stenosis with acute cerebral infarction serum CRP, Cys-C levels were high In the control group, P values were less than 0.05. See Table 2.

Group	Number of cases	Cys-C （mg / L）	CRP （mg / L）
Control Group	50	0.74±0.59	10.23±1.65
Mild Stenosis Group	48	1.14±0.27	15.48±2.73
Moderately Strict Group	41	1.42±0.30	18.59±3.38
Severe Stenosis Group	32	1.54±0.25	22.15±3.72

Table 2. Acute cerebral infarction with carotid artery stenosis serum CRP and serum Cys-C levels

3. Discussion

In patients with acute cerebral infarction over time after onset of irreversible neurological deficits progressive worsening of symptoms, its essence is caused by atherosclerosis of carotid artery stenosis and plaque loss caused by cerebral ischemia and hypoxia pathophysiology Process[4]. Urbonaviciene *et al*[5] 5-year follow-up of patients with atherosclerosis associated with elevated Cys-C found that the experimental group cardiovascular mortality was significantly higher than the control group, and CRP levels are closely related and confirmed with atheroma Like sclerosis-related acute and chronic inflammation. Visible serum levels of CRP and Cys-C have a close relationship with the incidence of acute cerebral infarction, but the relationship between them and acute cerebral infarction with carotid artery stenosis and the relationship between the degree of carotid artery stenosis rarely reported.

C-reactive protein (CRP) in the physiological condition of the serum concentration is very low level, when the body occurs trauma, infection, cell and tissue necrosis and other acute and chronic inflammation reaction CRP concentration will be significantly increased serum, is a typical inflammatory markers[6]. Some studies suggest that[7,8] CRP play a key role in the development of atherosclerosis, serum CRP levels can be used as an indicator of the severity of acute cerebral infarction and prognosis. The study also found that CRP CRP levels in patients with acute cerebral infarction complicated with carotid stenosis CRP levels higher, and the degree of carotid stenosis in the development of acute cerebral infarction plays an important role, which is more serious with carotid stenosis more prone to occur Consistent with the situation of cerebral infarction.

Cystatin C (Cys-C) is the most important inhibitor of endogenous cysteine protease produced by the nucleated cells of the body. It is widely distributed in the body and is generally used as an indicator of in vivo oxidative stress. Recent studies have found that [9] Cys-C is associated with the development of atherosclerosis. With the severity of atherosclerosis increasing, the level of Cys-C in serum is higher, and it is also closely related to the stability of atherosclerotic plaque. This study also found that serum Cys-C levels and acute cerebral infarction with carotid artery stenosis are closely related, and serum Cys-C levels and carotid stenosis more serious.

Acute cerebral infarction with carotid stenosis in patients with diverse clinical manifestations, the pathogenesis of complex. This study found that the difference in mean age, smoking history, body mass index (BMI), hypertension, diabetes, hyperlipidemia did not reflect the severity of acute cerebral infarction and the extent of carotid stenosis. Serum Cys-C, CRP and serum total bilirubin have been used as independent predictors of cerebral infarction after carotid artery stenting[10]. Serum Cys-C and CRP as an important indicator of inflammation in vivo, the study found that patients with acute cerebral infarction and carotid stenosis serum Cys-C and CRP levels were significantly higher than the control group, and by correlation analysis found that the two have a close linear correlation relationship. This may be related to the onset of acute cerebral infarction mediated immune inflammation. This suggests that the combined detection of serum Cys-C and CRP levels may be helpful for the early assessment of the severity and prognosis of acute cerebral infarction. It may also provide a reference for the assessment of the degree of stenosis in patients with acute cerebral infarction and carotid artery stenosis The next type of patients underwent carotid endarterectomy surgery to provide a reference.

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