

Changes in soluble cell adhesion molecules in patients with coronary heart disease before and after coronary stent implantation.

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Abstract

Objective: This study aims to investigate the changes in soluble cell adhesion molecules in patients with coronary heart disease before and after coronary stent implantation and to investigate the feasibility of SICAM-1 as an indicator to predict the postoperative coronary restenosis severity.

Methods: A total of 120 cases of patients with coronary stent implantation were selected as research objects. The coronary artery diameter was measured using enhanced CT. Restenosis severity and clinical symptoms were determined. Moreover, its relationship with the concentrations of SICAM-1 and sP-selectin were analysed.

Results: A total of 71 cases in patients occurred to be coronary restenosis. Sixty cases were considered non-cardiac events, and the number was significantly higher than that of patients with cardiac events ($P < 0.05$). The postoperative concentrations of sP-selectin and SICAM-1 were significantly higher than before operation ($P < 0.001$). No significant difference was found in the sP-selectin concentration between the non-restenosis and restenosis groups ($P > 0.05$). The SICAM-1 concentration in patients with cardiac events was 267.84 ± 47.68 ng/ml in the restenosis group, which was significantly higher than in patients with non-cardiac events (183.29 ± 58.99 ng/ml) in the restenosis group and (147.52 ± 94.11) ng/ml in the non-restenosis group ($P < 0.001$). The mean concentration of SICAM-1 in each group increased with the severity of coronary artery stenosis. Meanwhile, the highest concentration appeared in patients with cardiac events in the restenosis group.

Conclusion: The SICAM-1 concentrations in the patients with coronary heart disease showed significant difference before and after stent implantation. SICAM-1 can be used as a risk factor for assessing the coronary restenosis and progression.

Keywords: Coronary heart disease, Coronary artery, Stent implantation.

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Introduction

The cardiovascular and cerebrovascular diseases are serious diseases that endanger the health of human beings. Percutaneous Coronary Intervention (PCI) is an effective treatment for coronary heart disease [1]. Coronary artery stent implantation has become a widely applied technique because it can prevent acute and subacute vascular complications after simple coronary artery angioplasty as well as late lumen loss reduction. However, restenosis is still the main problem that restricts the application of this technology. Spiral CT perfusion imaging technique [2] can determine the severity of stenosis by vascular stenosis and perfusion imaging technologies.

However, due to delayed, transient, and progressive development of stenosis symptoms [3], it cannot dynamically monitor the condition, resulting in serious lagging of clinical work [4].

Multiple domestic and overseas researches showed that atherosclerosis and vascular stenosis had obvious inflammatory response, cerebrovascular intimal degeneration, and necrosis. The change in soluble cell adhesion molecules in patients with coronary heart disease before and after coronary stent implantation is determined in the paper to guide clinical diagnosis and treatment.

Data and Methods

General data

A total of 120 cases of patients with coronary heart disease in our hospital after coronary stent implantation were selected from 2015 to 2016, including 93 cases in male patients and 27 in females, averagely aged 45.71 ± 14.64 . The average duration of the disease was 3.85 ± 5.16 years. Exactly 70% of the patients had surgical indications of coronary artery stenosis. The patients were monitored in the intensive care unit to ensure normal electrolyte, blood pressure, and blood oxygen.

Detection methods

Vascular diameter measurement by spiral CT enhanced: CT examination was performed 2 days after the operation:

The femoral artery or brachial artery 1.0 cm puncture was conducted after local infiltration anesthesia. The needle was inserted into the aortic arch directed by the guider. The expander was placed. The artery sheath was flushed with the heparin saline. Coronary angiography was performed through the Simmons tube from three positions. The diameter of narrowest vessel was measured and recorded.

SICAM-1 serum specimen collection: About 10 ml fasting venous blood was drawn every morning before the surgery, immediately after the surgery, and in the postoperative 1-4 days. The blood sample was coagulated for 20-30 min at room temperature and centrifuged by 2500 r/min for 30 min. The serum was preserved at low temperature. Dynamic analysis was conducted.

Research methods

Stenosis severity was divided according to the coronary artery stenosis confirmed by spiral CT enhanced imaging, in

combination with the clinical symptoms. The patients with less than 50% stenosis inside the stent were regarded as the non-restenosis group. The patients with more than 50% restenosis were divided into the patients in the restenosis group and non-restenosis group according to whether cardiac events were present. The relationship between the concentrations of SICAM-1 and sP-selectin as well as vascular stenosis severity of patients immediately after the operation and within 4 postoperative days was analysed.

Statistical methods

The data were analysed using the SPSS16.0 software. The measurements of data were expressed using mean $\pm$ standard deviation ($\bar{x} \pm s$). The data counts were expressed using the percentage. The comparison among groups was performed using χ^2 test. $P < 0.05$ indicated that the difference was statistically significant.

Results

General data

A total of 120 cases of patients were included in the study. After coronary artery stent implantation and spiral CT examination, 49 cases in patients occurred to be coronary artery non-restenosis, and 71 cases in patients occurred to be coronary artery restenosis; the difference was statistically significant ($P < 0.05$). Among them, 60 cases in patients were considered non-cardiac events, which was significantly higher than that of cardiac events ($P < 0.05$). In addition, patients' age, sex, and blood pressure showed no significant difference ($P > 0.05$). The percentages of previous hyperlipidemia, hypertension, and diabetes showed no significant difference ($P > 0.05$). The number, diameters, and lengths of stents showed no significant difference ($P > 0.05$). The concentrations of sP-selectin and sICAM-1 were comparable, as shown in Table 1.

Table 1. Statistical analysis results of patients' general conditions.

	Item	Non restenosis group	Restenosis group		P value
			Non cardiac events	Cardiac events	
	Case (n)	49	60	11	<0.05
	Age (year)	62.71 $\pm$ 9.3	63.21 $\pm$ 5.6	62.77 $\pm$ 6.8	>0.05
Sex	Male (n/%)	38/79.59	47/78.33	8/72.72	>0.05
	Female (n/%)	11/22.45	13/21.67	3/27.27	
Blood Pressure	Systolic pressure (mmHg)	134.81 $\pm$ 17.52	132.87 $\pm$ 5.93	135.28 $\pm$ 14.17	>0.05
	Diastolic pressure (mmHg)	78.56 $\pm$ 10.4	79.23 $\pm$ 5.81	79.37 $\pm$ 5.82	
Complication	Hyperlipemia (n/%)	28/57.14	35/58.33	6/54.54	>0.05
	Hypertension (n/%)	30/61.22	36/60	8/72.72	
	Diabetes mellitus (n/%)	12/24.49	15/25.0	3/27.27	
Stent	1 (n/%)	33/67.35	41/68.33	2/18.18	>0.05

	2 (n/%)	13/26.53	15/25/0	3/27.27
	>3 (n/%)	3/6.12	4/6.68	6/54.54
Stent diameter (mm)	2.87 ± 0.77	2.88 ± 0.57	2.85 ± 0.93	>0.05
Bracket length (mm)	13.87 ± 3.6	14.12 ± 6.7	14.07 ± 5.2	

Concentrations of sP-selectin and sICAM-1 in patients

The postoperative concentrations of sP-selectin and sICAM-1 were significantly higher than those of preoperative concentrations ($P < 0.001$). However, the sP-selectin concentrations of patients in the non-restenosis and restenosis groups were increased in varying degrees. No significant difference was observed ($P > 0.05$). The postoperative sICAM-1

concentration was 267.84 ± 47.68 ng/ml in patients with cardiac events in the restenosis group, which was significantly higher than 183.29 ± 58.99 ng/ml in the patients with non-cardiac events in the restenosis group and 147.52 ± 94.11 ng/ml in the non-restenosis group ($P < 0.001$). With the severity of the disease, the sP-selectin concentrations showed no significant difference, whereas sICAM-1 showed progressive growth (Table 2).

Table 2. Concentrations of sP-selectin and sICAM-1 in patients (ng/ml).

Item	Point in time		Non restenosis group	Restenosis group	
	Pre-operation	Post-operation	Non cardiac events	Cardiac events	
sP-selectin	186.72 ± 41.68	217.98 ± 81.22 ^a	201.68 ± 100.89	207.89 ± 74.23	208.62 ± 66.47
sICAM-1	140.83 ± 77.65	154.67 ± 78.91 ^a	147.52 ± 94.11	183.29 ± 58.99 ^b	267.84 ± 47.68 ^c

Note: Compared with the preoperative, ^a $P < 0.001$; Compared with the non-restenosis group, ^b $P < 0.001$; Compared with the non-cardiac events, ^c $P < 0.001$.

Concentration of SICAM-1 in each group at each postoperative time point

The average concentration of SICAM-1 in each group increased with the severity of coronary artery stenosis and

showed positive growth. The highest concentration was found in the patients with cardiac events in the restenosis group, as shown in Table 3.

Table 3. Relationship between severity of coronary stenosis and SICAM-1 concentration (ng/ml).

Group	SICAM-1 Concentration				
	Postoperative immediate	Postoperative 24 h	Postoperative 48 h	Postoperative 3-5 d	Mean concentration
Non restenosis group	145.83	148.57	147.83 ± 48.27	144.47 ± 59.83	147.52 ± 94.11
Non cardiac events group	156	191.53 ± 62.83	187.87 ± 91.37	171.33 ± 52.63	183.29 ± 58.99 ^a
Cardiac events group	161.89	276.74 ± 64.33	285.37 ± 58.41	240.87 ± 91.42	267.84 ± 47.68 ^{ab}

Note: Compared with the non-restenosis group, ^a $P < 0.001$; Compared with the non-cardiac events in the restenosis group, ^b $P < 0.001$.

Discussion

Coronary heart disease is the most common heart disease. It is caused by coronary atherosclerosis, resulting in stenosis and insufficient blood supply [5]. Risks of rupture and shedding of atheromatous plaque in the blood vessel wall exist at any time. The plaque ruptures easily, which leads to coronary artery occlusion, resulting in a large area necrosis of myocardium and even sudden death [6,7]. Coronary stent can effectively correct the coronary artery stenosis, but restenosis may recur after surgery; therefore, the application of this technique is seriously restricted [8]. Spiral CT perfusion imaging can be used to predict the risk degree of vascular stenosis, but it is difficult to

accurately capture the occurrence indicator. No specific dynamic diagnostic indicator of vascular stenosis was found; hence, the progress of the disease is diagnosed only by clinical experience of physicians and is often lagged [9]. SICAM-1 is a kind of intercellular adhesion molecules, which enters the peripheral blood through the endothelial barrier. SICAM-1 is the main factor to resist the vascular wall inflammation during stenosis, ischemia and spasm [10]. The aim of this study was to investigate the feasibility of SICAM-1 as a dynamic index of coronary artery restenosis according to ischemia or inflammatory response after coronary stent implantation.

The results of the study showed that 71 cases in patients occurred to be coronary restenosis and 60 cases in patients were considered non-cardiac events, which was significantly higher than that of patients with cardiac events ($P < 0.05$). The postoperative concentrations of sP-selectin and sICAM-1 were significantly higher than before operation ($P < 0.001$). The postoperative sP-selectin concentrations in the restenosis group and restenosis group showed no significant difference ($P > 0.05$), suggesting that the sP-selectin concentrations showed no difference and could not be used as the indicator of coronary restenosis severity. This finding might be caused by the fact that sP-selectin mainly reflected the platelet activity. The patient had serious postoperative stress reaction. The platelet aggregation led to the increase of sP-selectin. However, it was not related to the postoperative coronary atherosclerosis, stenosis or ischemia. Moreover, sICAM-1 reflected the activity of endothelial cells. Being different from sP-selectin, the sICAM-1 concentration in patients with cardiac events was 267.84 ± 47.68 ng/ml in the restenosis group, which was significantly higher than that of patients with non-cardiac events, 183.29 ± 58.99 ng/ml in the restenosis group, and 147.52 ± 94.11 ng/ml in the non-restenosis group ($P < 0.001$). With disease severity, the mean sICAM-1 concentrations showed progressive growth. The concentrations of sICAM-1 were different in patients with coronary artery restenosis in varying degrees. The highest concentration was found in patients with cardiac events in the restenosis group. This finding was related to the number of stents and involved branch vessels as well as vascular stenosis degree. It could predict the risk degree of disease, which was consistent with the examination result of spiral CT perfusion enhancement.

Conclusion

CT perfusion enhancement examination is still a gold standard to diagnose vascular restenosis. It plays an irreplaceable role. However, as for the patients after coronary stent implantation, combined with serum sICAM-1 concentration monitoring can effectively predict the progress of the disease and realize the dynamic observation of coronary restenosis. To sum up, the sICAM-1 concentrations of patients with coronary heart disease were different before and after coronary stent implantation and could be used as an indicator to predict the risk factor of coronary restenosis.

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