

CORRELATION OF SERUM CD147 AND PCIII EXPRESSION LEVELS WITH THE PROGRESSION OF HYPERTENSIVE LEFT VENTRICULAR HYPERTROPHY

CHANGGUO CHEN, YIJIN WANG, JIMIN HE*

Department of Cardiovascular Disease, Yunnan Traditional Chinese Medicine Hospital, Kunming, PR China

ABSTRACT

Objective: To study the correlation between the expression levels of serum extracellular matrix metalloproteinase-inducing factor (CD147) and procollagen type III (PCIII) and the progression of hypertensive left ventricular hypertrophy.

Methods: Eighty-six hypertension cases who were treated in the Department of Cardiovascular Medicine of our hospital from May 2017 to March 2019 were randomly selected as research subjects. The participants were divided into simple essential hypertension groups (38 cases) and hypertension combined with left ventricular hypertrophy group (48 cases) based on whether the patients had left ventricular hypertrophy. At the same time, 40 cases who underwent health examinations in our hospital were selected as a normal control group. The expression levels of serum CD147 and PCIII, levels of high-sensitivity C-reactive protein (hs-CRP), platelets (PLT), white blood cells (WBC), N-terminal brain sodium-titanium precursor (NT-proBNP) and the changes of left ventricular end-diastolic dimension (LVEDD), interventricular septal thickness (IVST), left ventricular posterior wall thickness (LVPWT), left ventricular mass index (LVMI), and relative left ventricular wall thickness (RWT) in each group were measured. The correlation between serum CD147 and PCIII expression levels and the progression of hypertensive left ventricular hypertrophy was analysed by Pearson correlation test.

Results: Compared with the normal control group, the levels of serum CD147, PCIII, log (NT-proBNP), PLT, LVMI and RWT were significantly increased in the simple essential hypertension group ($P < 0.05$). Compared with the single essential hypertension group, serum CD147, PCIII, log (NT-proBNP), hs-CRP, PLT, WBC, LVMI, LVEDD, IVST, LVPWT and RWT levels were significantly higher in the hypertension combined with left ventricular hypertrophy group ($P < 0.05$). There was no significant difference in hs-CRP, WBC, LVEDD, IVST, and LVPWT levels between the normal control group and the simple essential hypertension group ($P > 0.05$). According to Pearson correlation analysis, the result showed that serum CD147 and PCIII levels were significantly positively correlated with log (NT-proBNP), PLT, LVMI, and RWT ($P < 0.05$).

Conclusion: Serum CD147 and PCIII levels in patients with hypertensive left ventricular hypertrophy are significantly increased, and the expression levels are related to the progression of hypertensive left ventricular hypertrophy.

Keywords: CD147, PCIII, hypertensive left ventricular hypertrophy, progression of disease course, correlation.

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Introduction

Primary hypertension is a cardiovascular syndrome with the main clinical manifestation of elevated systemic arterial pressure that often coexists with other cardio-cerebrovascular disease risk factors, which is a crucial cardio-cerebrovascular disease risk factor. With the development of social economy and the improvement of people's living standards, the incidence of hypertension and other diseases has increased significantly⁽¹⁾. According to statistics, there are about one billion people

with hypertension in the world, of which more than 250 million patients are in China. Hypertension in China has the characteristics of high prevalence, disability and mortality, which is a significant risk factor for cardiovascular disease⁽²⁾. The heart and blood vessels are the most important target organs for the pathophysiological effects of hypertension. Long-term hypertension can cause left ventricular hypertrophy and expansion, which in turn leads to cardiac remodelling and eventually develops into heart failure, which seriously affects people's health and quality of life⁽³⁾. Left ventricular hypertrophy is

a type of compensation that reduces the pressure of the heart wall and maintains heart function under high blood pressure and is a common complication of hypertension⁽⁴⁾. Some studies have found that the expression levels of serum extracellular matrix metalloproteinase inducer (CD147) and procollagen type III (PCIII) have close relationships with the occurrence and development of hypertension, but the relationship with left ventricular hypertrophy has been reported less frequently⁽⁵⁾. This study mainly explores the correlation between the serum CD147 and PCIII expression levels and the progression of hypertensive left ventricular hypertrophy.

Materials and methods

General data

Eighty-six patients with hypertension who were treated in the Department of Cardiovascular Medicine of our hospital from May 2017 to March 2019 were randomly selected as the research subjects. Participants were divided into a simple essential hypertension group (38 cases) and hypertension combined with left ventricular hypertrophy group (48 cases) according to whether the patients had left ventricular hypertrophy.

Inclusion criteria

- All patients met the diagnostic criteria for primary hypertension at the World Health Organization/International Hypertension Alliance Hypertension Conference⁽⁶⁾, that is systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg;

- All patients met the diagnostic criteria for hypertensive left ventricular hypertrophy⁽⁷⁾ according to the left ventricular mass index (LVMI), male ≥ 125 g/m², female ≥ 110 g/m²;

- This study was approved by the hospital ethics committee;

- Both the patient and family members were provided and signed an informed consent form.

Exclusion criteria

- Patients with secondary hypertension;
- Patients with severe cardiac dysfunction such as bradycardia, pericarditis and congenital heart disease;
- Patients with severe liver and kidney dysfunction;
- Patients who cannot cooperate with the treatment.

Among them, there were 23 males and 15 females in the simple essential hypertension group, where the average age was 60.29 ± 7.28 years, and

body mass index (BMI) was 24.24 ± 3.72 kg/m². In the hypertension combined with left ventricular hypertrophy group, there were 34 males and 14 females with an average age of 61.31 ± 7.46 years, and a body mass index (BMI) of 25.79 ± 4.95 kg/m². At the same time, 40 cases who underwent health examinations in our hospital were selected as normal control group. There were 27 males and 13 females, the average age was 63.67 ± 11.78 years, and the body mass index (BMI) was 23.65 ± 4.16 kg/m². There was no significant difference in age, gender, and BMI among the three groups ($P > 0.05$).

Observation indicators

All subjects were not allowed to drink or eat for more than 10 h. On the next day, 5 mL of fasting elbow median venous blood was collected, and the serum and blood cells were separated with a centrifuge (Beckman Coulter Co., Ltd. Model: Microfuge 16) at 3000 r/min. The supernatant was taken and stored in an ultra-low temperature refrigerator at -80°C (Jinan Chuangxiang Biological Technology Co., Ltd., model: MDF-193) for future inspection.

Determination of serum CD147 and PCIII levels

125IA-labeled antigen was used to determine human serum PCIII levels by an RIA equilibrium method. Serum CD147 levels were measured by an enzyme-linked immunosorbent assay.

Laboratory indicators

Hypersensitive C-reactive protein (hs-CRP), platelets (PLT), white blood cells (WBC), N-terminal brain sodium titanium precursor (N-terminal brain sodium titanium precursor, NT-proBNP) level were tested by a chemical masking method.

Cardiac function indicators

Left ventricular end-diastolic internal diameter (LVEDD), interventricular septum thickness (IVST) and left ventricular posterior wall thickness (LVPWT) in each group were measured using a Doppler ultrasound system (Liyang Hukang Medical Equipment Co., Ltd., model: DW-C8). Left ventricular mass index (LVMI) and relative left wall thickness (RWT) were calculated according to the formula. $\text{LVMI} = \{0.8 \times 1.04 \times [(\text{LVEDD} + \text{IVST} + \text{LVPWT})^2] + 0.6\} / [0.0061 \times \text{height (cm)} + 0.0128 \times \text{weight (kg)} - 0.1529]$; $\text{RWT} = (\text{LVPWT} + \text{IVST}) / \text{LVEDD}$.

Correlation analysis

The correlation between the expression levels

of serum CD147 and PCIII and the progression of hypertensive left ventricular hypertrophy was analysed by a Pearson correlation test.

Statistical methods

Measurement data were compared using an independent sample t-test between the two groups, and comparison between multiple groups was performed using a single-factor analysis of variance test. A count data comparison was performed using a χ^2 test. Human serum PCIII level was determined by an ¹²⁵I-labelled antigen by RIA equilibrium method. Serum CD147 levels were measured by an enzyme-linked immunosorbent assay.

The levels of hs-CRP, PLT, WBC and NT-proBNP were determined with a chemical masking method. The levels of LVEDD, IVST, LVPWT, LVMI and RWT were detected by Doppler ultrasound diagnostic equipment. The correlation between serum CD147 and PCIII expression levels and the progression of hypertension left ventricular hypertrophy was analysed by a Pearson correlation test. Statistical results are statistically significant with $P < 0.05$. This study used the SPSS18.0 software package for statistical data analysis.

Results

Comparison of serum CD147 and PCIII levels in each group

Compared with the normal control group, serum levels of CD147 and PCIII in simple essential hypertension group were significantly increased ($P < 0.05$); compared with patients with single essential hypertension, serum CD147 and PCIII level in hypertension combined with left ventricular hypertrophy group were increased significantly ($P < 0.05$). See Table 1.

Groups	Cases (n)	CD147 (pg/mL)	PCIII (μ g/L)
Normal control group	40	115.28 \pm 18.17	57.04 \pm 13.48
Simple essential hypertension group	38	158.71 \pm 32.46 ^a	98.92 \pm 22.14 ^a
Hypertension combined with left ventricular hypertrophy group	48	191.47 \pm 27.42 ^{ab}	111.52 \pm 24.98 ^{ab}
<i>F</i>		89.39	77.43
<i>P</i>		<0.001	<0.001

Table 1: Comparison of serum CD147 and PCIII levels in each group ($\bar{x}\pm s$).

Note: *a* means ^a $P < 0.05$ compared with the normal control group; *b* means ^b $P < 0.05$ compared with the simple hypertension group.

Comparison of laboratory index levels among groups

Compared with the normal control group, the levels of log (NT-proBNP) and PLT in the simple essential hypertension group were significantly increased ($P < 0.05$), the levels of hs-CRP and WBC were increased, but there was no significant difference between the two groups ($P > 0.05$).

Compared with the group of primary hypertension, the log (NT-proBNP), hs-CRP, PLT and WBC levels in the hypertension combined with left ventricular hypertrophy group increased significantly ($P < 0.05$). See Table 2.

Groups	Cases (n)	hs-CRP (mg/L)	PLT ($\times 10^9/L$)	WBC ($\times 10^9/L$)	Log (NT-proBNP)
Normal control group	40	2.307 \pm 1.17	148.14 \pm 29.85	6.03 \pm 1.16	1.44 \pm 0.25
Simple essential hypertension group	38	2.92 \pm 1.44	179.82 \pm 30.14 ^a	6.14 \pm 1.24	1.71 \pm 0.37 ^a
Hypertension combined with left ventricular hypertrophy group	48	5.17 \pm 2.06 ^{ab}	204.73 \pm 48.61 ^{ab}	7.14 \pm 1.22 ^{ab}	2.21 \pm 0.72 ^{ab}
<i>F</i>		36.65	23.96	11.45	26.12
<i>P</i>		<0.001	<0.001	<0.001	<0.001

Table 2: Comparison of laboratory index levels of patients in each group ($\bar{x}\pm s$).

Note: *a* means ^a $P < 0.05$ compared with the normal control group; *b* means ^b $P < 0.05$ compared with the simple hypertension group.

Comparison of cardiac function indexes of patients in each group

Compared with the normal control group, the levels of LVMI and RWT in patients with simple essential hypertension were significantly increased ($P < 0.05$). The levels of LVEDD, IVST and LVPWT increased, but there was no significant difference between the two groups ($P > 0.05$). Compared with the simple essential hypertension group, the levels of LVMI, LVEDD, IVST, LVPWT and RWT in the hypertension combined with left ventricular hypertrophy group were significantly increased ($P < 0.05$). See Table 3.

Groups	Cases (n)	LVEDD (cm)	IVST (cm)	LVPWT (cm)	LVMI (g/m ²)	RWT (cm)
Normal control group	40	4.14 \pm 0.24	0.92 \pm 0.15	0.89 \pm 0.13	92.77 \pm 11.11	0.39 \pm 0.08
Simple essential hypertension group	38	4.31 \pm 0.44	0.97 \pm 0.11	0.95 \pm 0.08	124.69 \pm 24.87 ^a	0.45 \pm 0.06 ^a
Hypertension combined with left ventricular hypertrophy group	48	4.99 \pm 0.44 ^{ab}	1.31 \pm 0.18 ^{ab}	1.25 \pm 0.17 ^{ab}	196.68 \pm 42.18 ^{ab}	0.53 \pm 0.08 ^{ab}
<i>F</i>		59.98	86.84	90.61	139.14	39.11
<i>P</i>		<0.001	<0.001	<0.001	<0.001	<0.001

Table 3: Comparison of cardiac function indexes of patients in each group ($\bar{x}\pm s$).

Note: *a* means ^a $P < 0.05$ compared with the normal control group; *b* means ^b $P < 0.05$ compared with the simple hypertension group.

Correlation analysis

By Pearson correlation test analysis, serum CD147 and PCIII levels were significantly positively correlated with log (NT-proBNP), PLT, LVMI, and RWT ($P < 0.05$), but not significantly correlated with hs-CRP and WBC ($P > 0.05$). See Table 4.

Indicators	CD147		PCIII	
	<i>r</i>	<i>P</i>	<i>r</i>	<i>P</i>
Log (NT-proBNP)	0.334	<0.05	0.349	<0.05
hs-CRP	0.023	>0.05	0.058	>0.05
PLT	0.274	<0.05	0.313	<0.05
WBC	0.011	>0.05	0.017	>0.05
RWT	0.512	<0.05	0.584	<0.05
LVMI	0.416	<0.05	0.424	<0.05

Table 4: Correlation analysis.

Discussion

Hypertension refers to a clinical manifestation with a non-specific, persistent increase in blood pressure, 95% of which is primary hypertension. With the aggravation of hypertension, the structural and function of cardiomyocyte hypertrophy, increased sarcomere and connective tissue are changed by the increased cardiac haemodynamics in hypertensive patients. This aggravation leads to an overall increase in ventricular mass, namely left ventricular hypertrophy that has become an inevitable structural change in hypertension and is a pathological manifestation of an abnormal increase in left ventricular mass and RWT⁽⁸⁾. According to related studies, left ventricular hypertrophy is one of the most crucial characteristics of target organ damage in hypertension and is a recognised independent risk factor⁽⁹⁾. As is well known, hypertension is prone to complications with left ventricular hypertrophy. Hypertensive left ventricular hypertrophy is closely related to increased cardiovascular risk, which has a critical relationship with the prognosis of adverse cardiovascular events, which is an independent predictor of sudden cardiac death⁽¹⁰⁾.

With the development of molecular cell biology, new progress has been made in the research mechanism of the occurrence and development of hypertension left ventricular hypertrophy, and it is believed that its occurrence has important relations with haemodynamics, neurohumoral regulation, inflammation, and cytokine interactions⁽¹¹⁾. CD147, also known as extracellular matrix metalloproteinase inducer, is one of the vital members of the immunoglobulin superfamily that is of considerable sig-

nificance in a variety of pathological conditions such as tumours, cardiovascular diseases and stroke⁽¹²⁾.

PCIII is a type of collagen, a precursor substance of procollagen type III terminal peptide, and is a sensitive indicator of active myocardial collagen synthesis. Salvetti et al.⁽¹³⁾ reported that PCIII was significantly increased in the process of myocardial fibrosis and promoted the further development of myocardial fibrosis at the same time, which played an important role in the process of myocardial fibrosis. PCIII can be used as an indirect indicator to evaluate the degree of myocardial fibrosis. It has been reported that PLT has a key function in the formation of arterial thrombosis, and the increase in PLT levels may be affected by its activation by CD147⁽¹⁴⁾. Hs-CRP and WBC are sensitive indicators of the body's inflammatory status. Hölttä et al.⁽¹⁵⁾ found that CD147 can interact with Cyclophilin A (CyPA) to induce the expression of matrix metalloproteinase (MMPs), promoting the differentiation and migration of inflammatory cells, thus promoting the proliferation of cardiac muscle cells and causes of myocardial hypertrophy.

In this study, compared with the normal control group, serum levels of CD147, PCIII, log (NT-proBNP), PLT, LVMI and RWT were significantly higher in the simple essential hypertension group ($P < 0.05$). Compared with the simple primary hypertension group, serum CD147, PCIII, log (NT-proBNP), hs-CRP, PLT, WBC, LVMI, LVEDD, IVST, LVPWT and RWT levels increased significantly in patients with hypertension combined with left ventricular hypertrophy ($P < 0.05$). There was no significant difference in hs-CRP, WBC, LVEDD, IVST and LVPWT levels between the normal control group and the simple essential hypertension group ($P > 0.05$).

Analysis with a Pearson correlation test showed that serum CD147 and PCIII levels were significantly positively correlated with log (NT-proBNP), PLT, LVMI and RWT ($P < 0.05$), which suggests that serum CD147 and PCIII levels are related to hypertension left ventricular hypertrophy, which can be used as an important indicator for its diagnosis. In summary, the levels of serum CD147 and PCIII in patients with hypertension left ventricular hypertrophy were significantly increased and their expression levels had a certain correlation with the progression of hypertension left ventricular hypertrophy.

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Corresponding Author:
JIMIN HE
Email: gyv991@163.com
(China)