

## **Hs-CRP and cTnI are associated with left ventricular remodeling in STEMI patients undergoing elective PCI treatment.**

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### **Abstract**

**Objective:** To explore the predictive value of high sensitive C Reactive Protein (hs-CRP) and serum cardiac Troponin I (cTnI) on left ventricular remodeling in patients with acute ST Segment Elevation Myocardial Infarction (STEMI) undergoing elective Percutaneous Coronary Intervention (PCI).

**Methods:** 140 cases of STEMI were selected accepting the offer PCI treatment in our hospital, after the onset of 3 days and 6 months after onset were measured Left Ventricular End Diastolic Volume (LVEDV), the comparison between LVEDV value, if the increase rate greater than 20% is classified as left ventricular remodeling group (n=80), <20% to for the non-left ventricular remodeling group (n=60). Detection of all patients with 24 h after the onset of serum hs-CRP, cTnI, and the use of logistic regression analysis of hs-CRP, cTnI and left ventricular remodeling.

**Results:** There was no significant difference (cTnI) in the left ventricular remodeling group after 3 days. The hs-CRP and cTnI of the left ventricular remodeling group were significantly higher than those of the non-reconstruction group (P<0.05) after 6 months; Logistic regression analysis showed that hs-CRP, cTnI were correlated with left ventricular remodeling (P<0.05).

**Conclusion:** cTnI and hs-CRP are associated with the left ventricular remodeling occurred after PCI treatment in patients with STEMI.

**Keywords:** hs-CRP, cTnI, Elective PCI, STEMI, Left ventricular remodeling.

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### **Introduction**

STEMI is one of common seen Myocardial Infarction (MI) in clinics. Most of them caused by decreased and interrupted coronary blood supply after coronary lesion, which causes severe and lasting myocardium acute ischemia [1]. STEMI have characteristics of severe coronary occlusion and big infarction area. So we treat it scalely after happens. The occurrence rate of Major Adverse Cardiovascular Events (MACE) in the near and specified future date is still high, the most common is left ventricular remodeling [2,3]. Left ventricular remodeling is an important index for predicting congestive heart failure and cardiovascular death after Acute Myocardial Infarction (AMI) [4]. After AMI, myocardial lesions and inflammatory reaction have relations with left ventricular remodeling, which make cTnI and hs-CRP become important indexes for predicting left ventricular remodeling [5]. The thesis aims at studying predictive value of hs-CRP and cTnI for patients with left ventricular remodeling after PCI in STEMI. The following are the detailed reports of this study.

### **Materials and Methods**

#### ***Clinical materials***

In this study, 140 cases of STEMI accepting selective PCI treatment in our hospital from January 2013 to January 2016 were selected. Within 3 days after onset and 6 months after onset, their Left Ventricular End Diastolic Volumes (LVEDV) were measured respectively, and compared. This research was approved by the animal committee of Ao Yang Hospital. If the increase rate was greater than or equal to 20%, it was classified in the left ventricular remodeling group (n=80), and if it was less than 20%, classified in the non-left ventricular remodeling group (n=60). There were 31 female cases and 49 male cases in the left ventricular remodeling group, aged from 46 to 79 years, and mean age of (65 ± 2) years; in the non-left ventricular remodeling, 25 female cases and 35 male cases, aged from 48 to 78 years, and mean age of (64 ± 3) years. The age, sex, risk factors, various biochemical indexes in both groups were compared, as shown in following Table 1.

#### ***Exclusion criteria***

Patients who met any one of the following circumstances should be excluded from this study [5]: 1. Patients with OMI;

2. Patients with secondary cardiac rupture, chordae tendinae rupture, acute heart failure and severe valvular disease; 3. Severe liver and kidney function deficiency; 4. Patients with malignant tumors; 5. Patients lost follow-up after operation.

### Methods

Medical history, symptoms, sign, electrocardiogram, biochemical indexes of all patients were collected. In the 8 h, 12 h and 24 h after the onset of disease, cTnI was detected by ICMAS through extracting elbow vein blood (maximum was selected in three). Serum hs-CRP value after the onset of 24 h was detected by immunoturbidimetry. LVEDV, LVESV, LVEF, LVEDD and LVESD were measured by echocardiogram during the acute onset of 3 days and 6 months after onset. After onset, emergency treatment was made for patients. Illness state was stabilized. Coronary angiography was operated from the 5 to 7 days of onset (multidimensional, multi-angle and multivessel observation, target vessel stenosis  $\geq 50\%$ , it was lesion vessel, stenosis  $\geq 70\%$ , it was target vessel). Stenosis vessel was operated selectively by PCI. Criterion of PCI success as followed: Lesion vessels stenosis reduced fewer than 20%; Patients felt symptoms improved obviously; No acute complications; No severe heart events at the time of

hospitalization. Once follow-up per month after patients' discharged from hospital.

### Evaluation index

After the onset of 3 days and 6 months after onset were measured left ventricular end diastolic volume (LVEDV), the comparison between LVEDV value, if the increase rate greater than 20% was classified as left ventricular remodeling group (n=80), <20% to for the non-left ventricular remodeling group (n=60). Detection of all patients with 24 h after the onset of serum hs-CRP, cTnI, and the use of logistic regression analysis of hs-CRP, cTnI and left ventricular remodeling.

### Statistical methods

All data in this study were analysed by SPSS19.0 software. T value test was used for measurement data. Chi-square test was used for comparison among groups. Test standard was  $\alpha=0.05$ .  $P<0.05$  indicated that there was statistical difference. Regression analysis of hs-CRP, cTnI and left ventricular remodeling were made by logistic.  $P<0.05$  indicated that there was statistical difference.

**Table 1.** Statistical table of basic information of patients in both groups.

Items		Left ventricular remodeling (n=80)	Non left ventricular remodeling (n=60)	t/ $\chi^2$ value	P value
Sex (Male/female)		49/31	35/25	1.104	0.062
Age (year)		46~79 (65 $\pm$ 2)	48~78 (64 $\pm$ 3)	0.932	0.067
Risk factors (n)	Older age ( $\geq 65$ )	35	32		
	Smoke	47	45		
	Hypertension	54	56		
	Hyperlipidemia	39	42	1.305	
	Glucose	27	26		0.056
Biochemical indexes	Blood glucose (mmol/L)	6.82 $\pm$ 1.12	6.79 $\pm$ 1.43		
	Creatinine ( $\mu\text{mol/L}$ )	83.26 $\pm$ 18.19	87.45 $\pm$ 13.08		
	uric acid ( $\mu\text{mol/L}$ )	339.37 $\pm$ 64.74	345.62 $\pm$ 50.34	0.953	0.085
	Triglyceride (mmol/L)	1.49 $\pm$ 0.46	1.58 $\pm$ 0.72		
	CHOL (mmol/L)	4.41 $\pm$ 1.15	4.31 $\pm$ 1.31		
	LDL (mmol/L)	2.35 $\pm$ 0.74	2.52 $\pm$ 0.65		
	HDL (mmol/L)	1.09 $\pm$ 0.23	1.01 $\pm$ 0.18		
Ultrasonic test	EF (EF/%)	52.32 $\pm$ 6.25	51.21 $\pm$ 7.39		
	LVD (cm)	5.17 $\pm$ 0.27	5.32 $\pm$ 0.36	1.284	0.053
Length of stay (d)		11.5 $\pm$ 3.5	12.0 $\pm$ 3.0	0.783	0.091

**Results**

***The levels of hs-CRP, cTnI of patients 3 days after disease onset in both groups***

The levels of hs-CRP and cTnI of patients 3 days and 6 months after onset of disease in both groups were shown in the following Table 2.

**Table 2.** *The levels of hs-CRP, cTnI of patients 3 days and 6 months after onset of disease in both groups.*

Group	Case number (n)	hs-CRP (mg/L)		cTnI (µg/L)	
		3 days after onset	6 months after onset	3 days after onset	6 months after onset
Left ventricular remodeling	80	10.12 ± 2.47	43.97 ± 12.74	8.75 ± 3.41	25.62 ± 5.37
Non left ventricular remodeling	60	10.95 ± 2.75	23.25 ± 9.01	8.44 ± 4.01	14.86 ± 4.02
χ <sup>2</sup>		0.904	5.408	1.032	4.984
P		0.062	0.017	0.074	0.028

**Table 3.** *The level of hs-CRP, cTnI after the onset of six months of patients in both groups.*

Group	Case number (n)	hs-CRP (mg/L)	cTnI (µg/L)
Left ventricular remodeling	80	43.97 ± 12.74	25.62 ± 5.37
Non left ventricular remodeling	60	23.25 ± 9.01	14.86 ± 4.02
χ <sup>2</sup>		5.408	4.984
P		0.017	0.028

***Echocardiogram comparison of patients in two groups at different times***

In third day, there was no difference between left ventricular remodeling and non- left ventricular remodeling with LVEDV and LVEF. In sixth month, non-left ventricular remodeling has a significant decrease with LVEDV and LVEF (χ<sup>2</sup>=3.967, P=0.039; χ<sup>2</sup>=4.836, P=0.027, Table 4).

**Table 4.** *Echocardiogram comparison of patients in two groups at different times.*

Group	Case number (n)	LVEDV (ml)		LVEF (%)	
		3 <sup>rd</sup> day	6 <sup>th</sup> month	3 <sup>rd</sup> day	6 <sup>th</sup> month
Left ventricular remodeling	80	118 ± 16	154 ± 29	47 ± 2	51 ± 3
Non left ventricular remodeling	60	119 ± 18	126 ± 21	48 ± 3	59 ± 5
χ <sup>2</sup>		0.931	3.967	1.038	4.836
P		0.063	0.039	0.053	0.027

***The level of hs-CRP, cTnI after the onset of six months of patients in both groups***

Compared with left ventricular remodeling, non-left ventricular remodeling has a significant decrease in hs-CRP and cTnI (χ<sup>2</sup>=5.408, P=0.017; χ<sup>2</sup>=4.984, P=0.028, Table 3).

***The results of logistic regression analysis***

Logistic regression analysis showed that hs-CRP and cTnI had relations with left ventricular remodeling (OR=1.23, P=0.027; OR=1.24, P=0.021) except irrelevant factors. The level of hs-CRP and cTnI got more high, the risk of left ventricular remodeling got more high.

**Discussion**

In recent years, with the improvement of people’s living level and changes of living modes, the incidence of coronary heart disease is increasing, especially high in the middle-aged and elderly people which stay at a high rate [6]. Coronary heart disease can cause many complications, especially in the advanced stage, it will lead to very dangerous complications, and one common complication is MI. Patients of MI have severe conditions, which need urgent treatment. The common treatments for MI are thrombolytic therapy, vasodilation, decrease of various high-risk factors, etc. But the effect of this therapy is unstable. The thrombolytic therapy will cause many complications with low safety. With the development of intervention therapy in clinics, the PCI is increasingly applied for vascular recanalization of patients with acute MI [7,8].

Myocardial ischemia after acute MI causes regional myocardial contraction. The ventricular remodeling occurs immediately after MI. Ventricular remodeling can be divided into extension phase of early MI and advanced overall ventricular dilatation according to different times [9]. In the early stage, ventricular remodeling can strengthen myocardial contractility and recover cardiac pump functions to some extent. However, the long-term ventricular remodeling can cause ventricular dilatation widely, finally cause heart failure. Therefore, ventricular remodeling is an important long-term

adverse event of prognosis after MI [10]. If the occurrence risk of ventricular remodeling can be predicted through index of myocardial enzymology, it will be of great significance to prediction for long-term prognosis of patients with MI and prevention for adverse cardiovascular events.

CRP is a kind of inflammatory acute RP synthesized by the liver, and it is one of the sensitive markers of acute nonspecific inflammation of body. Myocardial tissue ischemia may cause local necrosis and inflammation after MI occurs. Therefore, CRP is regarded as classical protein for MI detection, which can reflect inflammatory degree of Infarct Size (IS) [11]. In this study, there was no significant difference (hs-CRP) in hs-CRP levels between the left ventricular remodeling group and the non-reconstruction group ( $P>0.05$ ) in the initial stage (within 24 h); for the long-term (6 months), the hs-CRP level in the left ventricular remodeling group was significantly higher than that of the non-reconstruction group ( $P<0.05$ ); the logistic regression analysis showed that hs-CRP level was correlated with left ventricular remodeling ( $P<0.05$ ).

cTnI is a specific structural protein of myocardium, which only exists in myocardial tissue. cTnI is released into blood when myocardial injury happens, which increase the level of cTnI in blood. Therefore, cTnI is a sensitive specific marker for MI [12]. In this study, there was no significant difference in the peak cTnI values between the left ventricular remodeling group and the non-reconstruction group in the initial stage (24 h) after MI. The cTnI level of the left ventricular remodeling group was significantly higher than that of the non-reconstruction group ( $P<0.05$ ) after 6 months (long term after onset of disease); logistic regression analysis showed that cTnI level was correlated with left ventricular remodeling ( $P<0.05$ ).

In summary, hs-CRP and cTnI can be used to predict whether left ventricular remodeling occurs after selective PCI treatment for STEMI patients.

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