



Effect of emergency PCI combined with rh-BNP therapy on neuroendocrine indicators and cardiac function in patients with acute anterior myocardial infarction

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ARTICLE INFO

Article history:

Received
Received in revised form
Accepted
Available online

Keywords:

Acute anterior myocardial infarction
Emergency PCI
rh-BNP

ABSTRACT

Objective: To analyze the effect of emergency PCI combined with rh-BNP therapy on neuroendocrine indicators and cardiac function in patients with acute anterior myocardial infarction. **Methods:** A total of 70 cases with acute anterior myocardial infarction who received emergency rescue in our hospital from February 2012 to September 2014 were included for study, and all included patients were divided into control group 38 cases who received emergency PCI treatment alone and observation group 32 cases who received emergency PCI combined with rh-BNP therapy. Differences in the values of neuroendocrine indicators, ventricular collagen remodeling-related indicators, cardiac function indicators, myocardial injury-related indicators and so on were compared between two groups after treatment. **Results:** Serum ET, PRA, ALD, AngII, NE and E values of observation group after treatment were significantly lower than those of control group ($P < 0.05$); serum P [CP and PC] values of observation group after treatment were lower than those of control group, and P [CP/ PC] and TIMP-1 values were significantly higher than those of control group ($P < 0.05$); examination of cardiac function by color Doppler ultrasound showed that LAD, LVEDD, LVESD, LVESV and LVEDV values of observation group were lower than those of control group, and LVEF and LVFS values were significantly higher than those of control group ($P < 0.05$); serum CD14⁺⁺CD2L⁺, hs-cTnT, HBDH and H-FABP values of observation group after treatment were significantly lower than those of control group, and CD14⁺CD2L⁻ value was significantly higher than that of control group ($P < 0.05$). **Conclusions:** Emergency PCI combined with rh-BNP therapy for patients with acute anterior myocardial infarction can significantly improve cardiac function and inhibit ventricular remodeling, and it has positive clinical significance.

1. Introduction

Acute anterior myocardial infarction is clinically common, and patients who are admitted to hospital in time after onset can receive emergency percutaneous coronary intervention (PCI) for recanalization of coronary artery lesion and restoration of myocardial blood supply. Given the conditions such as insufficient

coronary reflow and severe ischemic myocardial injury in part of the cases after PCI operation, some scholars propose that anti-arrhythmia and myocardial protection drugs should be added in perioperative period of PCI so as to ensure the implementation of therapeutic effect[1,2]. Recombinant human brain natriuretic peptide (rh-BNP) is a clinical first-line drug for heart failure, which can protect myocardium while antagonize the activation of renin-angiotensin and other systems after myocardial infarction and avoid further microenvironment disorder in patients with myocardial infarction. In the research, the effect of emergency PCI combined with rh-BNP therapy on neuroendocrine indicators and cardiac function in patients with acute anterior myocardial infarction was mainly analyzed, specifically reported as follows.

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Fund project: Project of Sichuan Provincial Health Department (No: 130998).

2. Materials and methods

2.1. General information

A total of 70 cases with acute anterior myocardial infarction who received emergency rescue in our hospital from February 2012 to September 2014 were included for study, and then all included patients were divided into control group 38 cases who received emergency PCI treatment alone and observation group 32 cases who received emergency PCI combined with rh-BNP therapy. Control group included 21 male cases and 17 female cases, they were 45-71 years old and the average was (58.92±7.48) years; observation group included 18 male cases and 14 female cases, they were 42-73 years old and the average was (59.56±7.11) years. Differences in gender, age and disease severity were not significant between two groups ($P>0.05$).

2.2. Treatment methods

After admitted to hospital, all patients received inspection of electrocardiogram, myocardial enzyme spectrum, the coagulation time and so on as well as chewed aspirin 300 mg and clopidogrel 300 mg. Observation group of patients were treated with emergency PCI in combination with rh-BNP, specifically as follows: Seldinger's technology was used for right femoral artery puncture, arterial sheath was placed, selective coronary angiography was performed, and electrocardiogram results were combined to clarify the coronary artery lesion. Before coronary angiography, ordinary heparin sodium 2 500 U was intravenously injected, ordinary heparin sodium was added to 100 U/kg before PCI, rh-BNP load capacity 10 µg/kg was slowly intravenously injected, the injection was finished within 5 min, then 0.15 µg/kg min dose was used for slow intravenous drip, maintaining for total 16-24 h, and heparin sodium 1 000 U was added for each 1 more hour of operation time. Control group received PCI alone, and the methods as well as the dosage and usage of heparin sodium were the same as those of observation group of patients.

2.3. Cardiac function detection and serum indicator determination

Neuroendocrine indicators included endothelin (ET), plasma renin activity (PRA), aldosterone (ALD), angiotensin II (AngII), norepinephrine (NE) and epinephrine (E).

Ventricular collagen remodeling-related indicators included carboxy terminal peptide of type I procollagen (P I CP), procollagen type III (PC III), P I CP/ PC III and tissue inhibitor of metalloproteinase-1 (TIMP-1).

Cardiac function indicators included left atrium diastolic diameter (LAD), left ventricular end-diastolic diameter (LVEDD), left ventricular end-systolic end (LVESD), left ventricular end-systolic

volume (LVESV), left ventricular end-diastolic volume (LVEDV), left ventricular ejection fraction (LVEF) and left ventricular fractional shortening (LVFS).

Myocardial injury-related indicators included typical monocytes (CD14⁺CD2L⁺), atypical monocytes (CD14⁺CD2L⁻), high-sensitivity cardiac troponin T (hs-cTnT), α-hydroxybutyrate dehydrogenase (HBDH) and heart-type fatty acid-binding protein (H-FABP).

2.4. Statistical methods

Data obtained in the research was analyzed by SPSS23.0 software, measurement data was in terms of mean±sd, comparison between two groups was analyzed by *t* test and $P<0.05$ was set as the standard of statistical significant differences.

3. Results

3.1. Neuroendocrine indicators

Detection of them after PCI operation showed that serum ET, PRA, ALD, AngII, NE and E values of observation group after treatment were significantly lower than those of control group ($P<0.05$), shown in Table 1.

3.2. Ventricular collagen remodeling-related indicators

In the research, detection of ventricular collagen remodeling-related indicators showed that serum P I CP and PC III values of observation group after treatment were significantly lower than those of control group, and P I CP/ PC III and TIMP-1 values were significantly higher than those of control group ($P<0.05$), shown in Table 2.

3.3. Cardiac function indicators

In the research, the examination of cardiac function by color Doppler ultrasound showed that LAD, LVEDD, LVESD, LVESV and LVEDV values of observation group were significantly lower than those of control group, and LVEF and LVFS values were significantly higher than those of control group ($P<0.05$), shown in Table 3.

3.4. Myocardial injury-related indicators

In the research, detection of myocardial injury marker levels through serum showed that serum CD14⁺CD2L⁺, hs-cTnT, HBDH and H-FABP values of observation group after treatment were significantly lower than those of control group, and CD14⁺CD2L⁻ value was significantly higher than that of control group ($P<0.05$), shown in Table 4.

Table 1

Comparison of neuroendocrine indicator values between groups after treatment.

Groups	ET (ng/L)	PRA [μ L/(L h)]	ALD (pmol/L)	AngII (ng/L)	NE	E
Observation group	94.37 \pm 8.11	1.17 \pm 0.13	121.27 \pm 11.54	103.47 \pm 9.48	1.67 \pm 0.13	401.82 \pm 39.63
Control group	121.58 \pm 10.94	2.53 \pm 0.21	178.63 \pm 16.95	131.65 \pm 12.49	3.15 \pm 0.27	614.39 \pm 58.63
<i>t</i>	8.342	5.384	8.293	9.234	6.023	11.274
<i>P</i>	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Table 2

Comparison of ventricular collagen remodeling-related indicator values between groups after treatment.

Groups	P I CP (μ g/L)	PC III (ng/L)	P I CP/PC III	TIMP-1 (ng/mL)
Observation group	11.28 \pm 1.05	20.38 \pm 1.95	0.61 \pm 0.05	68.34 \pm 5.99
Control group	14.27 \pm 1.63	33.65 \pm 3.29	0.42 \pm 0.04	59.62 \pm 5.41
<i>t</i>	5.483	8.942	5.093	7.584
<i>P</i>	<0.05	<0.05	<0.05	<0.05

Table 3

Comparison of cardiac function indicator values between groups after treatment.

Groups	LAD (mm)	LVEDD (mm)	LVEDS (mm)	LVESV (mL)	LVEDV (mL)	LVEF (%)	LVFS (%)
Observation group	27.49 \pm 2.37	47.28 \pm 4.39	29.17 \pm 2.54	35.64 \pm 3.49	100.37 \pm 9.83	62.15 \pm 5.88	34.27 \pm 3.13
Control group	32.16 \pm 3.09	52.31 \pm 4.76	35.06 \pm 3.24	52.17 \pm 4.99	121.64 \pm 11.48	57.29 \pm 5.34	29.83 \pm 2.76
<i>t</i>	6.594	7.283	7.094	8.394	7.342	9.384	5.374
<i>P</i>	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Table 4

Comparison of myocardial injury-related indicator values between groups after treatment.

Groups	CD14 ⁺ CD2L ⁺ (106/L)	CD14 ⁺ CD2L ⁻ (106/L)	hs-cTnT (ng/L)	HBDH (U/L)	H-FABP (ng/mL)
Observation group	435.71 \pm 40.93	712.84 \pm 68.73	114.83 \pm 10.75	178.39 \pm 16.33	4.28 \pm 0.39
Control group	682.82 \pm 59.77	500.64 \pm 43.27	264.97 \pm 23.15	241.27 \pm 20.41	8.11 \pm 0.76
<i>t</i>	13.047	14.382	10.384	12.384	6.498
<i>P</i>	<0.05	<0.05	<0.05	<0.05	<0.05

4. Discussion

Acute anterior myocardial infarction is one of the most common types of clinical myocardial infarction, and for patients who are found in a timely manner and eligible, emergency PCI is the most effective way of coronary artery recanalization and saving myocardial function. But at present, many studies have shown that after PCI treatment, patients with ST-segment elevation myocardial infarction are with no reflow, slow blood flow and other phenomena, and unable to achieve the reperfusion at myocardial level, and for such patients, the effect of PCI on improving their short-term and long-term prognosis worrying[3]. Brain natriuretic peptide (BNP) is mostly stored in ventricular muscle, ventricular load and ventricular wall tension change can stimulate BNP synthesis and secretion, and more studies have shown the BNP has positive significance in the diagnosis and therapeutic effect evaluation of myocardial infarction and heart failure. rh-BNP is a synthetic BNP analogue and currently the first-line drug for treatment of heart failure, and it has no positive inotropic or positive rate effect, does not increase muscle oxygen consumption and is without the risk of inducing arrhythmia[4,5]. A study shows that rh-BNP application can increase the glomerular filtration rate, produce significant diuretic effect, reduce the systemic resistance and relieve ventricular afterload, and is an effective drug to improve and balance the vascular and renal hemodynamics. In the research, rh-BNP was applied in observation group before and during PCI, and the effect of rh-BNP on the treatment outcome of patients with acute anterior myocardial infarction was mainly observed.

After myocardial infarction, hemodynamic disorder, massive release of necrotic substances and inflammatory factors in infarction area, activated sympathetic nervous system and renin-angiotensin system and activated neuroendocrine system can regulate the

stability of cardiovascular function and maintain blood and life viscera perfusion to a certain extent[6]. But continued neuroendocrine responses is bad for the heart itself and is the promoting factor of deterioration. After PCI, infarction coronary is recanalized and blood supply of heart muscle cells is recovered to different degrees, and the body's reactive neuroendocrine activation state has to be effectively reduced. ET, PRA, ALD, AngII, NE and E are the main components of the renin-angiotensin system, they can be massively produced and secreted into the blood after myocardial infarction, and rh-BNP can suppress adrenergic, RAAS and endothelin system activated in heart failure and maintain the myocardial contractility and heart rate in the steady state[7,8]. Above research results showed that serum ET, PRA, ALD, AngII, NE and E values of observation group were lower after treatment, indicating that compared with control group who received PCI operation alone, adding rh-BNP therapy contributed to the stability of adrenergic, RAAS and endothelin system and avoid further aggravation of myocardial infarction.

Myocardial infarction ischemia and the resulting secondary injury such as neuroendocrine activation can all cause ventricular remodeling, and severe cases can cause congestive heart failure. Ventricular remodeling includes cardiomyocyte hypertrophy apoptosis and myocardial matrix changes. In myocardial matrix, fibroblast accounts for the vast majority, and the collagen secreted by it accounts for 25% of myocardial volume, including type I and type III collagen that surround and connect the myocardial cells, and maintain normal cardiac systolic and diastolic function at appropriate component ratio[9]. Cardiac collagen remodeling process includes type I and type III collagen deposition, and the ratio and crosslinking methods between the two types of collagen abnormally change. Excessive collagen deposition can lead to decreased ventricular passive resilience, decreased compliance as well as cardiac diastolic and systolic dysfunction. In the research, detection of ventricular

collagen remodeling-related indicator values of two groups after treatment showed that postoperative serum P [CP and PC] values of observation group were lower, and P [CP/ PC] and TIMP-1 values were higher[10]. TIMP-1 is the specific inhibitor of MMP-1, high level of TIMP-1 can block the activation of MMP-1 and inhibit the destruction of original collagen network of the heart, and it plays a positive role in inhibiting myocardial extracellular matrix remodeling. The above results showed that the application of rh-BNP in perioperative period of PCI could effectively restrain infarcted myocardial collagen remodeling, maintain the existence of I type and collagen type III in proper proportion.

After myocardial infarction, patients trend to have decreased cardiac function and myocardial cell injury, specifically manifested as abnormal cardiac diastolic and systolic function, the massive production of serum myocardial injury markers, etc. LAD, LVEDD, LVESD, LVESV, LVEDV, LVEF and LVFS are all the cardiac systolic and diastolic function-related parameters that can be obtained under the color Doppler ultrasound[11]. Above results showed that LAD, LVEDD, LVESD, LVESV and LVEDV values of observation group were lower, and LVEF and LVFS values were higher. LAD, LVEDD, LVESD, LVESV and LVEDV are all heart compliance-related indicators, and the increase of their values indicate reduced heart compliance; both LVEF and LVFS are intuitive indicators of cardiac systolic function, high levels of them indicate strong cardiac contraction ability, and the above results showed that rhBNP combined with PCI treatment was helpful to maintain normal cardiac systolic and diastolic function and compliance. Myocardial ischemic injury in infarction area will inevitably lead to the release of all kinds of damage markers from the cells into the blood, cause the increase of serum myocardial injury marker levels, and can be used as the objective indicator to judge the severity of disease and therapeutic effectiveness. Above research results showed that serum CD14⁺CD2L⁺, hs-cTnT, HBDH and H-FABP values of observation group were lower after treatment, and CD14⁺CD2L⁻ value was higher. Typical monocytes (CD14⁺CD2L⁺) can promote inflammation and remove dead cells, and atypical monocytes (CD14⁺CD2L⁻) can reduce inflammation and promote tissue repair[12,13]. High-sensitivity cardiac troponin T (hs-cTnT) is the troponin with the highest detection sensitivity, can detect slight heart damage, and is with clinical high disease directivity and prediction value in treatment outcome. HBDH actually reflects the activity of lactate dehydrogenase isozyme, it is of certain significance for the diagnosis of myocardial disease, and in cases of myocardial injury, its level increases. H-FABP specifically exists in myocardial tissue, can be combined with the long chain fatty acids in myocardial cells and ultimately generate adenosine triphosphate, for the heart function. In cases of myocardial ischemia hypoxia, H-FABP in myocardial cells rises rapidly and is released into the blood through the myocardial cell membrane, and its diagnostic sensitivity of myocardial ischemic diseases is as high as 88%[14,15]. The above results suggested rhBNP combined with PCI surgery could reduce myocardial damage and effectively protect myocardium after coronary artery recanalization.

To sum up, it is concluded as follows: emergency PCI combined with rh-BNP therapy for patients with acute anterior myocardial infarction can significantly improve cardiac function and inhibit ventricular remodeling, and it's worth popularization in clinical practice in the future.

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