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Research Article

Clinical Efficacy of Recombinant Brain Natriuretic Peptide in Patients with Acute Myocardial Infarction After On-Pump Coronary Artery Bypass Grafting (CABG)

Xidong Zhang

Department of cardiac surgery, Anhui Provincial Hospital, Hefei, China

Abstract: ***Objective:*** To evaluate the clinical efficacy of intravenous recombinant human brain natriuretic peptide (rhBNP) in patients with acute myocardial infarction after on-pump coronary artery bypass grafting (CABG). ***Methods:*** 40 cases of coronary heart disease, left ventricular ejection fraction < 50% and (plasma brain natriuretic peptide in type N terminal) NT-proBNP > 300 pg/ml underwent on-pump coronary artery bypass surgery with cardiopulmonary bypass were enrolled and randomly divided into two groups, experimental group of 20 patients after operation on the basis of conventional therapy plus recombinant human brain natriuretic peptide treatment (first loading dose of 1.5 μg/kg intravenously, to maintain dose of 0.01 μg/kg/min continuous infusion of 72h), 20 cases of the control group was given routine treatment, observe two groups of patients before and after treatment of blood pressure, heart rate, urine volume, blood creatinine and NT-proBNP, and to observe the left ventricular ejection fraction (LVEF), echocardiography and the length of time the index. ***Results:*** the experimental group after treatment, urine volume, left ventricular ejection fraction (LVEF), cardiac index (CI) was significantly higher than that before treatment, the serum creatinine, plasma N - terminal pro brain natriuretic peptide (NT-proBNP), the content of serum troponin T peptide (cT nT), creatine kinase isoenzyme (CK MB) was significantly lower than before treatment. ***Conclusion:*** Recombinant human brain natriuretic peptide can improve cardiac and renal function in patients with acute period of acute myocardial infarction underwent coronary artery bypass surgery, shorten the hospitalization time, and it is safe and feasible.

Keywords: Natriuretic peptide; Brain; Coronary artery bypass grafting; Myocardial infarction; Renal function; Hemodynamics

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****Corresponding author:*** Xidong Zhang, donis@yeah.net

1 Introduction

Brain natriuretic peptide (BNP) is mainly secreted by the ventricle and plays the role of diuretic, antihypertensive, natriuretic and diastolic smooth muscle. Genetically recombined human brain natriuretic peptide has the same biological activity as endogenous brain natriuretic peptide, so its mechanism of action is also the same as endogenous brain natriuretic peptide. At present, many studies at home and abroad have shown brain natriuretic peptide therapy. Effectiveness and safety of heart failure[1]. Coronary heart disease patients undergoing off-pump heart bypass surgery can easily cause neurohormonal and renal responses similar to acute heart failure[2]. In this study, from January to December 2018, 40 patients with coronary heart disease underwent cardiopulmonary bypass surgery. Of these, 20 patients were treated with recombinant human brain natriuretic peptide on the basis of conventional treatment after surgery. The recovery status of heart and kidney function of patients in this group, the specific report is as follows.

2 Objects and methods

2.1 Clinical information

Forty patients with coronary artery disease with multivessel angiography who underwent coronary bypass surgery under cardiopulmonary bypass were selected. Preoperative cardiac ultrasound showed a left ventricular ejection fraction (LVEF) <50% and NT-proBNP> 300 pg / ml. Randomly divided into rhBNP experimental group and control group, 20 cases in the experimental group, aged 68 to 77 years, with an average of 73.2 years. Admitted cardiac function: 10 cases of grade I, 10 cases of grade II; 12 cases with hypertension, and 10 cases with diabetes. Twenty patients in the control group, aged 63-78 years, with an average age of 72.4 years, were admitted to the hospital with 12 levels of killip grade I, 8 cases of grade II, 10 with history of hypertension, and 10 with diabetes.

2.2 Method

Randomly divided into experimental group and control group, the experimental group added rhBNP to the control group, 20 cases each. Method of administration: The patients in the rhBNP group were used immediately after returning to the ICU. They were first statically pushed at a loading dose of 1.5 μg/kg, and then maintained at a constant dose of 0.01 μg/kg/min for 72 h. After withdrawal from the ICU, the patients were discontinued, and changes in indicators such as echocardiography, renal function, plasma NT-proBNP, and postoperative hospital stay were observed in the two groups.

2.3 Statistical methods

SPSS 11.0 was used to analyze the measurement data. The measurement data was expressed as ($x \pm s$). Comparisons between groups were performed by t test. $P<0.05$ was considered statistically significant.

3 Results

There were no significant differences in left ventricular ejection fraction (LVEF), serum creatinine, glomerular filtration rate (eGFR), and plasma NT-proBNP levels between the two groups of patients before surgery ($P>0.05$). See Table 1; The left ventricular ejection fraction (LVEF), serum creatinine and glomerular filtration rate, plasma NT-proBNP, changes in ICU hospitalization time, and 24-hour urine volume were all statistically significant in the experimental group after surgery. $P<0.05$). The comparison of intraoperative and postoperative data between the two groups is shown in Tables 2 and 3.

Table 1. Comparison of preoperative data between 2 groups of patients ($x \pm s$)

Group	N	LVD	SCr			NT-proBNP
		(mm)	(%)	(μmol/L)	(ml/min)	(pg/mL)
Control group	20	56.8±3.9	46.9±1.3	70.3±8.9	117.8±18.7	1010.87±380.1
Experimental group	20	56.1±2.8	47.6±1.4	69.2±5.7	130.2±11.7	1865.34±699.9
P		0.795	0.487	0.597	0.551	0.495

Table 2. Comparison of some data during and after surgery（$x \pm s$）

Group	N	Cbp time	Max changes in sCr	Max changes in eGFR	Postoperative hospital stay
		(min)	(μmol/L)	(ml/min)	(d)
Control group	20	101.3±15.7	75.2±29.1	-52.9±12.1	10.9±5.7
Experimental group	20	112.8±24.9	38.5±21.7	-2.21±10.7	8.7±3.8
P		0.521	0.044	0.031	0.039

Table 3. Comparison of some postoperative data between the two groups of patients（$x \pm s$）

Group	N	24 h Change in heart index	24 h Urine output	ICU	LVEF	LVD	Change in NT-proBNP
		[L/(min·m^2)]	(ml)	time(d)	(%)	(mm)	(%)
Control group	20	0.5±0.5	2229±773	76.9±27.9	52.2±3.3	56.1±4.5	420±167
Experimental group	20	0.7±0.8	2859±1079	42.6±37.9	53.4±3.1	54.8±3.5	189±132
P		0.377	0.024	0.425	0.382	0.287	0.028

4 Discussion

Brain natriuretic prptide (BNP) was first isolated from porcine brain tissue by Japanese scholar Sudho and others. It is also called B-type natriuretic peptide. It is an endogenous polypeptide composed of 32 amino acids secreted by the atrium and ventricle. Mainly ventricular secretion. Ventricular secreted brain natriuretic peptide (BNP) is a self-protective compensatory response of the heart to antagonize the pathological damage to the heart. It is called "cardiac load emergency rescue hormone". Its physiological functions are relatively diverse, including dilating blood vessels, especially coronary vessels, diuretic diuretics, blocking the RAAS system and the SNS system, participating in the regulation of blood volume, blood pressure, and salt balance in the body, in addition to inhibiting myocardial fibrosis and anti-coronary The role of arterial spasm[3].

Patients with acute myocardial infarction (AMI) have a rapid rise in plasma BNP levels. The main mechanisms are due to the rapid decline in ventricular systolic and diastolic function after AMI, the overload of volume, and the traction at the border between the infarcted and non-infarcted areas. The wall tension is increased[4]. At present, a large number of studies at home and abroad have confirmed that the plasma BNP level reaches a peak level of up to 60 times that of normal people 21 to 48 hours after AMI[5]. On the fifth day, patients with acute anterior myocardial infarction, with pump failure, low LVEF, and later developed ventricular aneurysm had increased BNP, and BNP showed a biphasic curve. In addition, elevated plasma BNP levels can reflect infarct size, assess the extent of the lesion, and determine prognosis. Patients with acute myocardial infarction in the acute phase are often accompanied by varying degrees of cardiac function impairment before surgery. Under surgical stress, especially after continuous coronary artery bypass graft surgery, severe cardiac dysfunction can be associated with postoperative pulmonary edema, Low cardiac output, acute and chronic kidney failure and other heart failure manifestations affect patients' short- and long-term prognosis. At this time, exogenous BNP supplementation can effectively improve the treatment effect[6].

The level of NT-proBNP during coronary pericardial bypass surgery varies in gender and age. Generally, women are slightly higher than men, and older patients are higher than young patients. Studies have confirmed that when BNP < 100 pg/mL or NT-proBNP < 400 pg/mL, the negative predictive value of heart failure is 90%[7]. Studies have shown that the level of plasma BNP in patients undergoing non-stop coronary artery bypass graft surgery begins to increase on the first day after surgery, reaches a peak on the third day after surgery, and begins to fall, and decreases significantly on the seventh day after surgery, but is still higher than before surgery. Level[8-9]. This study showed that human NT-proBNP levels began to rise after surgery and lasted for several days, which may be related to myocardial damage during coronary artery transplantation.

From this study, rhBNP treatment was given to the experimental group after surgery, which produced a more effective effect. Cardiac ultrasound of the experimental group showed that the left ventricular ejection fraction (LVEF) was significantly higher than before treatment. Content, cTnT, and CK-MB were significantly lower than before treatment. In addition, it improved the glomerular filtration rate of patients, reduced the peak value of serum creatinine, and had fewer adverse reactions.

Based on the above discussion, the clinical treatment of myocardial infarction, the use of coronary bypass surgery under cardiopulmonary bypass, and the addition of rhBNP to basic treatment after surgery can better improve cardiac function, relieve clinical symptoms and signs, and reduce major cardiovascular dysfunction. There were fewer incidents and shortened ICU hospital stay. Due to the small sample size and short-term use in this study, the long-term benefit of rhBNP after CABG needs further study.

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