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Original Article

Thrombus management during direct coronary intervention for acute myocardial infarction

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Abstract: Objective: To study the management of thrombus during direct coronary intervention in patients with acute myocardial infarction (AMI). Methods: We retrospectively analyzed 332 acute myocardial infarction patients receiving coronary artery intervention in our hospital from May 2017 to May 2019. Among them, 221 patients received thrombus aspiration and 111 patients received thrombus aspiration combined with platelet membrane glycoproteins receptor antagonist. The propensity score matching 1:1 nearest neighbor matching method was adopted to match 50 cases of the two methods as the control group and the experimental group, respectively. The incidence rate of intraoperative and postoperative adverse reactions, the effective rate of treatment, the electrocardiogram (ECG) at 1 h after operation, and the echocardiographic results at 1 week after operation were compared between the two groups. Results: The incidence rate of adverse reactions in the experimental group was significantly lower than that in the control group, ($P<0.05$). The incidence rate of postoperative adverse reactions in the two groups did not statistically differ ($P>0.05$). The effective rate was found to be substantially higher in the experimental group when compared with that of the control group ($P<0.05$). The ECG 1 h after operation was in favor of the experimental group ($P<0.05$). The echocardiography results 1 week after operation were not statistically different in the two groups ($P>0.05$). Conclusion: Thrombus aspiration combined with receptor antagonist yielded a desirable outcome in direct coronary intervention for AMI, and has a high application value.

Keywords: Acute myocardial infarction, direct coronary intervention, thrombus management, thrombus aspiration, receptor antagonist

Introduction

Acute myocardial infarction (AMI) is an acute cardiovascular disease commonly seen in clinical practice, with the features of short onset time, rapid development and high mortality. Patients with AMI will be prone to cardiovascular collapse and death if timely treatment lacks [1-3]. At present, the commonly used clinical treatment of AMI is coronary intervention that removes the myocardial infarction focus and accelerates normal work of heart. Direct interventional therapy is an important way of myocardial revascularization, but may cause distal microcirculation embolism or no reflow during operation. Such phenomenon will aggravate the patient's condition, thus reducing the success rate of operation [4-6]. Therefore, it is a concern of direct coronary intervention for AMI in clinical medicine to find an optimal option for thrombus management. Thrombus aspiration refers to pumping out thrombus in the infarct focus with catheter so as to remove thrombus, while platelet membrane glycoprotein receptor antagonist treatment is the use of drugs for targeted thrombolysis [7-9]. In order to find a more reasonable way of thrombus management, this paper selected patients with AMI treated by direct coronary intervention as the research objects and different thrombus managements were used respectively. The adverse reactions, ECG findings and cardiac ultrasound results of the patients were analyzed, so as to clarify the application effect of thrombus aspiration treatment and thrombus aspiration combined with receptor antagonistic treatment. The specific research reports are as follows.

Data and methods

General data

We retrospectively analyzed 332 AMI patients receiving coronary artery intervention in our

Table 1. Comparative statistics of general data ($\bar{x}\pm sd$)

Group	Experimental Group	Control Group	X^2/t	P
Gender (Male/Female)	26/24	27/23	0.04	0.84
Age (Year)	55.34±3.69	55.61±3.58	0.37	0.71
Height (cm)	166.92±10.32	167.11±10.51	0.09	0.93
Weight (kg)	73.10±8.84	73.55±8.22	0.26	0.79
Course of disease (Year)	5.33±1.06	5.19±1.12	0.64	0.52
Time to hospital (h)	1.30±0.26	1.35±0.33	0.84	0.40
Hypertension (case)	11	9	0.25	0.62
Diabetes (case)	10	11	0.06	0.81
Hyperlipidemia (case)	6	5	0.10	0.75

hospital from May 2017 to May 2019. Among them, 221 patients received thrombus aspiration and 111 patients received thrombus aspiration combined with platelet membrane glycoproteins receptor antagonist. The propensity score matching 1:1 nearest neighbor matching method was adopted to match 50 cases of the two methods as the control group and the experimental group, respectively. The baseline information in the two groups were homogeneous (P>0.05). See **Table 1**.

Inclusion/exclusion criteria

Inclusion criteria: ① Patient with acute myocardial infarction, AMI; ② Direct coronary intervention was performed; ③ No history of drug allergy, drug abuse or bad habits; ④ No recent cardiovascular disease; ⑤ The study was approved by the hospital ethics committee. All patients participated in the study voluntarily and signed the informed consent.

Exclusion criteria: ① The patient had mental disorder and could not cooperate with the study; ② The patient died before emergency treatment; ③ With congenital heart disease.

Methods

After admission, patients of the two groups underwent routine emergency examination to detect vital signs and cardiac color ultrasound or CT detection to determine the site of myocardial infarction.

The patients in the control group were treated with thrombus aspiration. The catheter was placed through the interventional guide wire, so that one end of the catheter was close to the infarct site. The thrombus site was repeatedly aspirated, and the coronary angiography was observed. If the coronary angiography showed that the infarct site became lighter in color after repeated aspiration, the stenting operation could be carried out [10-12]. After operation, patients needed to take aspirin (manufacturer: Bayer HealthCare AG; SFDA approval number: J20130078; Specification: 100 mg) combined with clopidogrel (manufacturer: Shenzhen Salubris Pharmaceuticals Co., Ltd.; SFDA approval number: H20000542; Specification: 75 mg) for treatment, with aspirin 1 tablet/time, 1 time/day, and clopidogrel 1 tablet/time, 1 time/day. The prognosis was observed 1 month later.

The patients in the experimental group were treated with receptor antagonist on the basis of the control group. Patients underwent coronary angiography and received intravenous drop of tirofiban (manufacturer: Lunan Beite Pharmaceutical Co., Ltd.; SFDA approval number: H20090225) 10 μg/kg within 3 min, and the remaining half of tirofiban was administered at 0.075 μg/kg·min for 24 h to complete the infusion. The amount of bleeding was observed during the operation, and the infusion of tirofiban was stopped immediately if massive bleeding was found.

Observation index

The incidence of intraoperative and postoperative adverse reactions, the effective rate of treatment, the ECG performance 1 h after operation and the cardiac ultrasound results 1 week after operation were compared between the two groups.

If there was no such cases as slow blood flow or no reflow or massive bleeding during the operation, it was considered markedly effective; if there was slow blood flow and no massive bleeding during the operation, it was considered effective; if there was no reflow during the operation, it was considered ineffective.

The ECG performance was based on the ST segment of the patient's ECG to evaluate

Table 2. Comparison of the incidence rate of intraoperative adverse reactions between the two groups

Group	Slow blood flow	No reflow	Rising blood pressure	Decreasing blood oxygen	Incidence rate (%)
Experimental group	1	0	2	0	6%
Control group	3	2	7	5	34%
X^2					12.25
P					<0.001

Table 3. Comparison of the incidence rate of postoperative adverse reactions between the two groups

Group	Wound infection	Rising body temperature	Total incidence rate (%)
Experimental group	3	5	16%
Control group	4	3	14%
X^2			0.08
P			0.78

Table 4. Comparison of the effective rates of the two groups

Group	Markedly effective	Effective	ineffective	Total effective rate (%)
Experimental group	36	13	1	98%
Control group	14	26	10	80%
X^2				8.27
P				0.004

the ECG resolution in postoperative ST segment. The resolution value in ST segment = elevation value in preoperative ST segment - elevation value in postoperative ST segment.

Echocardiography mainly observed left ventricular ejection fraction, left ventricular inner diameter and left ventricular anteroposterior diameter.

Statistical analysis

In this study, the data analysis was done using SPSS20.0 software, and GraphPad Prism 7 (GraphPad Software, San Diego, USA) was used to plot graphs. The count data were expressed as [n (%)], and X^2 test was applied to examine the difference; measurement data were given as mean ± deviation ($\overline{x} \pm sd$), and t-test was performed to determine the difference. The significance was claimed at a *p* value of <0.05.

Results

Comparison of incidence rate of adverse reactions between the two groups

The results showed that patients had adverse reactions such as slow blood flow, no reflow, rising blood pressure and decreasing blood oxygen. The incidence rate of adverse reactions in the experimental group was found to be lower than that in the control group (P<0.05). The adverse reactions after operation mainly included surgical wound infection and rising body temperature. There was no significant difference in postoperative adverse reactions between the two groups (P>0.05). See **Tables 2** and **3**.

Comparison of effective rate of the two groups

Table 4 details that the effective rate of the experimental group was 98%, and that of the control group was 80% (P<0.05).

Comparison of ECG performance 1 h after operation between the two groups

The comparison results showed that the ST segment resolution value of the experimental group was significantly higher than that of the control group with statistical significance (P<0.05). See **Figure 1**.

Comparison of cardiac color ultrasound result 1 week after operation between the two groups

The results showed that the difference in left ventricular ejection fraction, left ventricular

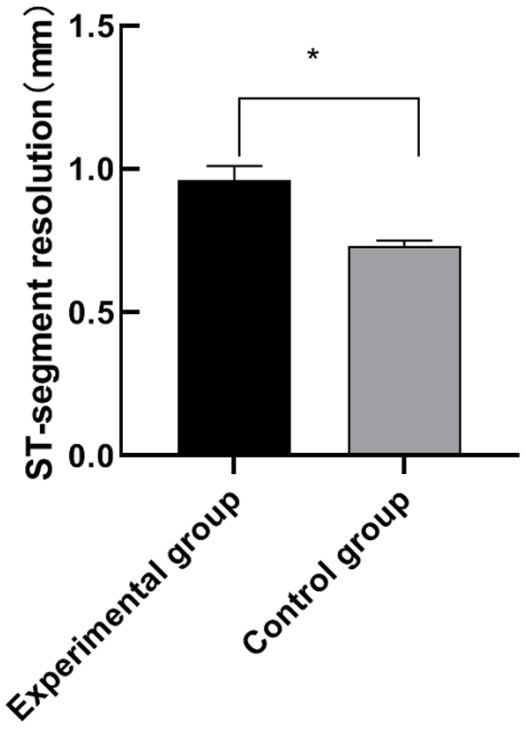

Figure 1. Comparison of ECG performance 1 h after operation between the two groups. Note: the abscissa shows the experimental group and the control group from left to right, and the ordinate shows the ST segment resolution value. *represents that ST segment resolution value of the experimental group (0.96±0.05 mm) was statistically different from that of the control group (0.73±0.02 mm) (t=30.20, P<0.001).

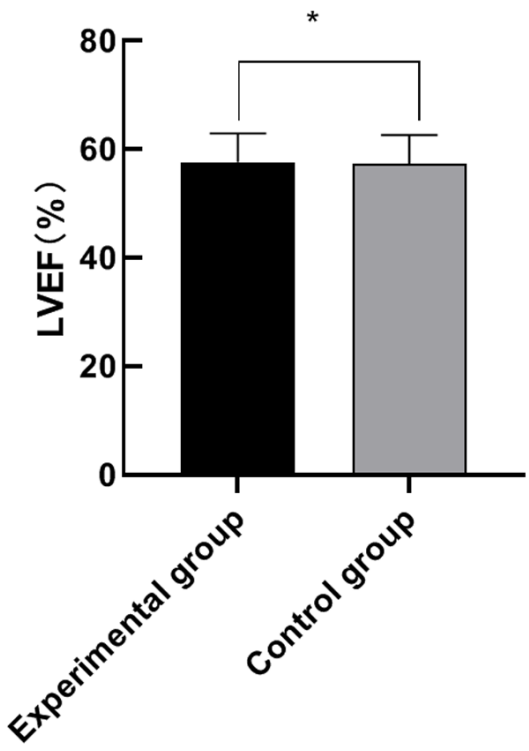

Figure 2. Comparison of left ventricular ejection fraction between the two groups. Note: the abscissa shows the experimental group and the control group from left to right, and the ordinate shows the left ventricular ejection fraction. *represents that the left ventricular ejection fraction of the experimental group (57.63±5.27%) was not statistically different from that of the control group (57.29±5.36%) (t=0.32, P=0.75).

inner diameter and left ventricular anteroposterior diameter between the two groups was not statistically significant (P>0.05). See **Figures 2** and **3**.

Discussion

Every year, tens of thousands of patients die of AMI, which is likely to occur in patients with coronary heart disease. Due to coronary atherosclerosis in patients with coronary heart disease, the cardiac blood supply is insufficient, which seriously affects the myocardial function [13-15]. AMI refers to angina pectoris, arrhythmia or even shock or death due to the lack of fresh blood in patient's heart as the blood in the artery cannot smoothly complete the circulation caused by blocking in artery by the coronary artery plaque rupture [16-18]. In case of AMI, emergency treatment should be provided timely. Clinical treatment for patients with AMI is coronary intervention by installing pacemaker to assist heart function [19]. However, because the infarct site of patients with AMI affects blood circulation, direct installation may lead to distal microcirculation embolism or vascular collapse, leading to death. Therefore, corresponding management should be carried out on thrombus site before cardiac stent implantation to avoid no reflow. To our best knowledge, the common options of thrombus management are thrombus aspiration and receptor antagonist management. This study was undertaken with an attempt to find an appropriate way of thrombus management for AMI treated by direct coronary intervention.

The findings of the present study showed that the effective rate of the experimental group was comparatively higher than that of the control group, and the incidence of intraoperative adverse reactions was evidently lower than that of the control group (P<0.05). It is assumed

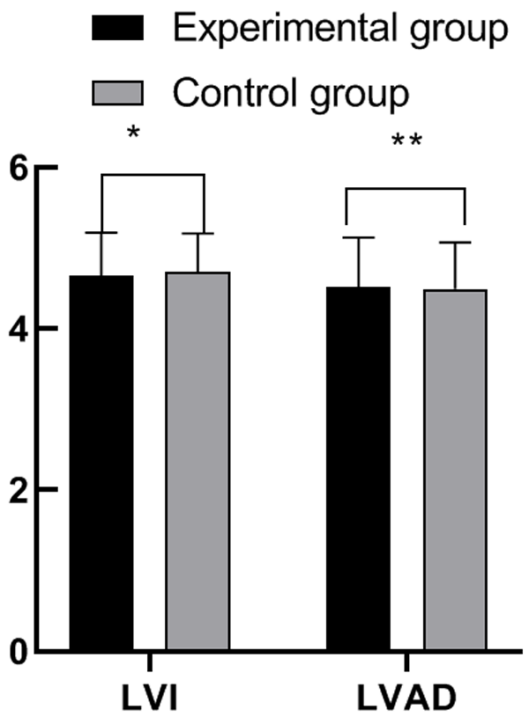

Figure 3. Comparison of left ventricular inner diameter and left ventricular anteroposterior diameter between the two groups. Note: the abscissa shows the left ventricular inner diameter and left ventricular anteroposterior diameter from left to right, and the ordinate shows the measured value (cm). *represents that the left ventricular inner diameter of the experimental group (4.66±0.53 cm) was not statistically different from that of the control group (4.70±0.48 cm) (t=0.40, P=0.69); **represents that the left ventricular anteroposterior diameter of the experimental group (4.52±0.61 cm) was not statistically different from that of the control group (4.49±0.58 cm) (t=0.25, P=0.80).

that thrombus aspiration combined with receptor antagonist can significantly improve the safety of coronary intervention, reduce the risk of operation, thus increasing the success rate. Additionally, the ECG results 1 h after operation of the experimental group showed that the ST segment resolution value was significantly higher than that of the control group (P<0.05). Cheng et al. [20] demonstrated in their study that tirofiban combined with thrombus aspiration significantly improved the success rate of coronary intervention in patients with AMI, and reduced the incidence of adverse reactions. Therefore, it is in conformity with the current study, which rationalizes the use of tirofiban. The combination of thrombotic aspiration and tirofiban (class IIA recommendation, level B evidence) for treatment remains controversial. In this study, we provided more scientific evidence that thrombus aspiration combined with intracoronary injection of tirofiban during direct PCI is still an effective method to improve the blood flow of coronary circulation and save the endangered myocardium. However, the efficacy of PCI combined with thrombotic aspiration for AMI needs to be further confirmed in large-scale randomized clinical trials.

Moreover, the results showed that the comparison of incidence rate of postoperative adverse reactions, left ventricular ejection fraction, left ventricular inner diameter and left ventricular anteroposterior diameter in the two groups were not statistically significant (P>0.05), which indicated that thrombus aspiration combined with receptor antagonist and thrombus aspiration garnered a similar effect in prognosis.

Hence, we suggest that thrombus aspiration combined with receptor antagonist is a promising option for AMI. It significantly improves the success rate of operation and reduces the risk.

Disclosure of conflict of interest

None.

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