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Effect of urokinase thrombolysis on the cardiac function, coagulation, and fibrinolytic system in patients with AMI

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ABSTRACT

Objective: To observe the effect of urokinase thrombolysis on the cardiac function, coagulation, and fibrinolytic system in patients with acute myocardial infarction (AMI). **Methods:** A total of 39 patients with AMI who were admitted in our hospital from March, 2016 to November, 2016 were included in the study and served as the observation group. The peripheral venous blood before and after thrombolysis was collected. The plasma NT-proBNP level, related coagulation factors, and fibrinolysis indicators were detected. The cardiac function before treatment was evaluated. A total of 30 healthy individuals who came for physical examinations were served as the control group for contrastive analysis. **Results:** The plasma NT-proBNP, Fg, and D-D levels before thrombolysis in the observation group were significantly higher than those in the control group, while PT, APTT, and TT in the observation group were significantly shortened. The plasma NT-proBNP and D-D levels 2-48 h after thrombolysis in the observation group were significantly elevated first and reduced later and reached the peak 4 h after treatment, while PT, APTT, and TT were significantly extended first and shortened later. The plasma Fg level was significantly reduced first and elevated later and reached the minimum 4 h after treatment. During the treatment process, in the observation group, 2 had mucocutaneous hemorrhage, 3 had nasal hemorrhage, and 1 had gingival bleeding, but no gastrointestinal bleeding or cerebral hemorrhage occurred. **Conclusions:** The thrombolytic therapy can effectively reduce the coagulation activity in patients with AMI, strengthen the fibrinolysis activity, and improve the cardiac function.

1. Introduction

Acute myocardial infarction (AMI) is a common clinical emergency and severe disease, whose pathogenesis is closely associated with the thrombogenesis, coagulation, and fibrinolytic change. The thrombolytic therapy can rapidly recanalize the involved coronary artery, and regulate the coagulation and fibrinolytic system, with a significant efficacy. However, during the thrombolytic therapy process, the risk of bleeding due to excessive thrombolysis or another embolism caused by inadequate thrombolysis is usually accompanied; therefore, it is of great significance in monitoring the cardiac function indicators, coagulation indicators, and fibrinolysis factor level, which can provide guidance for AMI patients with the condition and treatment protocol, and contribute to enhance the therapeutic effect[1−3]. The study is aimed to observe the effect of urokinase thrombolysis on the cardiac function, coagulation, and fibrinolytic system in patients with AMI.

2. Materials and methods

2.1. Clinical materials

A total of 39 patients with AMI who were admitted in our hospital

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Table 1.
Comparison of the cardiac function, coagulation, and fibrinolysis indicators before and after treatment between the two groups.

Groups	*n*	NT-proBNP	PT	APTT	TT	Fg	D-D
Observation group	39	328.3±29.7**	11.6±2.5**	27.6±2.5**	12.1±4.9**	3.9±1.1**	0.6±0.3**
Control group	30	148.5±23.6	14.8±2.1	36.9±2.3	15.3±4.4	2.2±0.9	0.3±0.2

**P<0.01, when compared with the control group.

Table 2.
Changes of cardiac function, coagulation, and fibrinolysis indicators before and after treatment in the observation group.

Time	NT-proBNP	PT	APTT	TT	Fg	D-D
Before treatment	328.3±29.7	11.6±2.5	27.6±7.5	12.1±4.9	3.9±0.6	0.6±0.3
2 h after treatment	511.3±161.4	15.6±2.6	42.2±11.3	18.2±5.0	2.1±0.4	1.0±0.2
4 h after treatment	762.4±152.1	21.4±3.5	47.5±8.9	22.3±5.1	1.6±0.3	1.2±0.2
12 h after treatment	572.6±98.4	18.5±3.3	40.2±8.4	18.5±4.6	1.9±0.5	0.9±0.18
24 h after treatment	461.9±89.9	15.8±2.8	35.4±5.6	14.4±4.1	2.2±0.6	0.7±0.2
48 h after treatment	351.4±67.8	12.1±2.5	29.2± 6.8	12.6± 3.6	3.5±0.7	0.6±0.4

from March, 2016 to November, 2016 were included in the study and served as the observation group, among which 16 were male, and 23 were female; aged from 36 to 67 years old; 11 had posterolateral infarction, 13 had inferior infarction, and 15 had extensive anterior infarction. Inclusion criteria: (1) those who were in accordance with related diagnostic criteria of AMI[4]; (2) those who were confirmed by ECG and serum enzymology; (3) those who had no contraindications to thrombolytic therapy and no allergic reaction to urokinase from onset to 12 h after admission. Those who had severe hematological system disease and other severe organic diseases were excluded from the study. A total of 30 healthy individuals who came for physical examinations were served as the control group, among which 15 were male, and 15 were female; aged from 35 to 65 years old. The comparison of baseline information between the two groups was not statistically significant (P>0.05), but it was comparable.

2.2. Methods

The patients in the observation group were given nitrates, aspirin, clopidogrel, statins, ACEO or ARBs, and β receptor blocker, and were administrated with urokinase (produced by Heilongjiang Dilong Pharmaceutical Co. Ltd., Approval No. H23020108, 1 million) for thrombolytic therapy 12 h after admission. Urokinase (1 million U) was dissolved in 100 mL normal saline, ivdrip, for 30 min. After 6 min, low-molecular-weight heparin (5000 IU) was subcutaneously injected, 1 time/12 h, for 5 d.

2.3. Observation indicators

The morning fasting venous blood before thrombolysis in the two groups was collected. The morning fasting venous blood after thrombolysis in the observation group was collected, centrifuged for the plasma, and preserved at -20℃ for detection. The radioimmunoassay was used to detect the plasma NT-proBNP level. ACL Futura plus full automatic coagulation analyzer (Coulter) was used to detect PT, APTT, TT, Fg, D-D, and fibrinolytic indicators. The recanalization rate and the occurrence of hemorrhage during the treatment process was observed and recorded.

2.4. Statistical analysis

SPSS 19.0 software was used for the statistical analysis. Data of cardiac function indicators, coagulation and fibrinolysis indicators were expressed as mean ± SD. The independent t test was used for the comparison between the two groups. One-way ANOVA was used for the comparison at each timing point before and after thrombolysis in the observation group. Data of recanalization rate and the occurrence of hemorrhage were expressed as percentage. P<0.05 was regarded as statistically significant.

3. Results

3.1. Comparison of the cardiac function, coagulation, and fibrinolysis indicators before and after treatment between the two groups

The plasma NT-proBNP, Fg, and D-D levels before thrombolysis in the observation group were significantly higher than those in the control group (P<0.01), while PT, APTT, and TT were significantly lower than those in the control group (P<0.01) (Table 1).

3.2. Changes of cardiac function, coagulation, and fibrinolysis indicators before and after treatment in the observation group

The plasma NT-proBNP and D-D levels 2-48 h after thrombolysis in the observation group were significantly elevated first and reduced later (P<0.01) and reached the peak 4 h after treatment, while PT, APTT, and TT were significantly extended first and shortened later (P<0.05 or P<0.01). The plasma Fg level was significantly reduced first and elevated later (P<0.01) and reached the minimum 4h after treatment (Table 2).

3.3. Occurrence of adverse reactions during the treatment process in the observation group

During the treatment process, in the observation group, 2 had mucocutaneous hemorrhage, 3 had nasal hemorrhage, and 1 had gingival bleeding, but no gastrointestinal bleeding or cerebral hemorrhage occurred.

4. Discussion

Some researches demonstrate that[5,6] the plasma coagulation activity is strengthened, and the blood is in a hypercoagulation state; moreover, various coagulation factors and fibrinolytic indicators are closely associated with the occurrence and development of AMI. Thrombolysis is an effective means in the treatment of AMI, and plasminogen activators, such as streptokinase and urokinase are mostly involved in the thrombolytics, which can play a thrombolytic effect through turning the plasminogen into fibrinolysin, and split the cross-linked fibrinogen; meanwhile, thrombolytics can split various coagulation factors to promote low coagulation in order to reach the goal of thrombolysis[7-9].

PT and APTT are the main indicators to evaluate the exogenous and intrinsic coagulation functions, whose shortening or extending can reflect the elevation or reduction of plasma levels of related coagulation factors. TT can main reflect the time of coagulation I turning into fibrin under the effect of thrombin. TT extension represents the reduction of plasma coagulation I level, and meanwhile the anti-coagulation effect is obviously strengthened[10,11]. The results in the study showed that PT, APTT, and TT before thrombolysis in the observation group were significantly lower than those in the control group (P<0.05), indicating that thrombolysis can significantly increase the fibrinolysis activity in patients with AMI, reduce the coagulation activity, and contribute to rapid dissolution of thrombus. Fg and D-D are important indicators to evaluate the fibrinolytic system activation. Fg is a key indicator to reflect the plasma viscosity, and is also a cofactor of platelet aggregation[12]. The plasma Fg level elevation suggests that the blood is probably in a hypercoagulation state, and has a risk of thrombosis. D-D is a specific degradation product of cross-linked fibrin by fibrinolysin, whose plasma content elevation suggests the secondary hyperfibrinolysis, is a typical marker molecule of hypercoagulation and thrombosis, and is also a key factor to identify the primary and secondary hyperfibrinolysis. The blood flow change and plasma viscosity are significantly increased in patients with AMI, accompanied by thrombosis and secondary hyperfibrinolysis. The results in the study showed that the plasma Fg and D-D levels before treatment in the observation group were significantly higher than those in the control group (P<0.05), proving that the blood in AMI patients in a hypercoagulation state in different degrees[13]. NT-proBNP level can directly reflect the early cardiac function in patients with AMI, and is also a risk stratification indicator of acute myocardial ischemia in patients with coronary heart disease[14]. The results in the study showed that NT-proBNP level before treatment in the observation group was significantly higher than that in the control group (P<0.05), indicating that thrombolytic therapy can rapidly improve the myocardial blood supply in patients with AMI, and recover the cardiac function. The results in the study showed that the plasma NT-proBNP and D-D levels 2-48 h after thrombolysis in the observation group were significantly elevated first and reduced later (P<0.01) and reached the peak 4 h after treatment, while PT, APTT, and TT were significantly extended first and shortened later (P<0.05 or P<0.01); the plasma Fg level was significantly reduced first and elevated later (P<0.01) and reached the minimum 4h after treatment, which is consistent with some reports[15,16]. In the treatment process, it should pay attention to that various coagulation system factors which can activate the body are involved in the thrombolytic therapy. After thrombolytic therapy, thrombolysis and plaque rupture can reexpose the wound surface to the air, accompanied by the risk of bleeding, even leading to gastrointestinal bleeding, cerebral bleeding or peritoneal bleeding, which can severely endanger the patients' life. The results in the study showed that during the treatment process, in the observation group, 2 had mucocutaneous hemorrhage, 3 had nasal hemorrhage, and 1 had gingival bleeding, but no gastrointestinal bleeding or cerebral hemorrhage occurred, indicating that the risk of bleeding should be evaluated, the condition should be closely monitored, and the clinical medications should be reasonably guided before the thrombolytic therapy with urokinase.

In conclusion, the thrombolytic therapy can effectively reduce the coagulation activity in patients with AMI, strengthen the fibrinolysis activity, and improve the cardiac function.

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