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EC PULMONOLOGY AND RESPIRATORY MEDICINE

Research Article

Comparative Analysis of Prognosis of Thrombolysis and Anticoagulation for Acute Medium-to-High Risk Pulmonary Thromboembolism

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Received: February 04, 2020; **Published:** February 19, 2020

Abstract

Objective: To investigate the effects of thrombolysis and anticoagulation on the prognosis of patients with acute medium-to-high risk pulmonary thromboembolism.

Methods: A retrospective analysis was performed on 76 patients with acute medium-to-high risk PTE who were treated in our hospital from July 2016 to July 2018. They were divided into two groups according to the treatment method. Anticoagulation therapy was used on the control group, and thrombolytic therapy was used in the observation group. Clinical efficacy, blood gas analysis indicators, D-dimer levels, bleeding status, and recurrence rate were then compared between the two groups.

Results: The total clinical effective rate in the observation group was 91.43%, which was higher than the control group's 70.73%, and the difference was statistically significant ($P < 0.05$). The PO2 and D-dimer levels in the observation group after treatment were (81.26 ± 7.85) mmHg and (3.24 ± 0.82) mg/L respectively, which was higher than the control group's (71.36 ± 7.32) mmHg and (2.43 ± 1.45) mg/L, with a statistically significant difference ($P < 0.05$). There was no statistically significant difference in PCO2 levels between the two groups ($P > 0.05$). The bleeding rate in the observation group was 37.14%, which was higher than the control group's 4.88%, with a statistically significant difference ($P < 0.05$). The recurrence rate in the observation group (5.71%) was lower than that of the control group (21.95%), with a statistically significant difference ($P < 0.05$).

Conclusion: For patients with acute medium-to-high risk pulmonary thromboembolism, early thrombolytic therapy is more effective. It is beneficial for rapidly increasing the partial pressure of arterial oxygen and reducing the long-term relapse rate, but there is a certain risk of slight bleeding.

Keywords: *Pulmonary Thromboembolism; Thrombolysis; Anticoagulation; Relapse; Bleeding; Blood Gas Analysis*

Introduction

Pulmonary thromboembolism (PTE) is a clinically critical cardiovascular disease, which can be divided into three types: low-risk, intermediate-risk, and medium-to-high risk. The clinical manifestations of the disease include hemoptysis, dyspnea, and chest pain. If left untreated, the mortality rate can reach 25% -30%, while the mortality rate is still as high as 5% - 10% even with correct and timely

treatment [1]. Anticoagulation is the most basic treatment for PTE since it can affect different aspects of the coagulation process through anticoagulant drugs and thereby prevent blood clotting. Still, this treatment cannot directly dissolve existing thrombi [2]. Thrombolysis is also a common way to treat PTE, since it can directly degrade plasminogen to plasmin, thereby rapidly lysing fibrin and dissolving thrombi [3]. At present, the clinical use of anticoagulant therapy in patients with low-risk PTE and normal blood pressure can achieve a good prognosis. However, the prognostic effect of different treatment methods for patients with medium-to-high risk PTE is still controversial [4].

Purpose of the Study

The purpose of this study was to analyze the effects of thrombolysis and anticoagulation therapy on the prognosis of patients with acute medium-to-high risk PTE.

Materials and Methods

General data

The clinical data of 76 patients with acute medium-to-high risk PTE who were treated in our hospital from July 2016 to July 2018 were retrospectively analyzed. The patients had been divided into two groups according to the treatment methods, with forty-one patients who received anticoagulation treatment set as the control group and thirty-five patients who received thrombolytic therapy set as the observation group. The control group consisted of 25 males and 16 females aged 52 - 79, with an average age of (68.14 ± 6.52) years; 29 of these patients were at intermediate risk, and 12 were at high risk. In the observation group, there were 22 males and 13 females aged 51 - 80 with an average age of (68.20 ± 6.51) years; 24 of these patients were at intermediate risk, and 11 were at high risk. There was no significant difference in general information between the two groups ($P > 0.05$).

Inclusion criteria: Met PTE diagnostic criteria; no symptoms such as shock, hypotension, etc.; echocardiography showing right heart dysfunction; informed consent of patients and their families.

Exclusion criteria: Concomitant structural intracranial disease, recent brain surgery, etc.; thrombolytic contraindications.

Methods

Both groups were given essential treatments such as vital sign monitoring and oxygen inhalation. The control group was treated with anticoagulants, and 0.4 mL of low-molecular-weight heparin (Shenzhen Sabol Biopharmaceutical Co., Ltd., Chinese Medicine Standard: H20052319) was injected subcutaneously every 12 hours. At the same time, oral warfarin (Shanghai Xu Donghaipu Pharmaceutical Co., Ltd., Chinese Medicine Standard: H31020112) was given as treatment at an initial 2.5 mg/d, and the patient's international normalized ratio (INR) was monitored. When INR was at 2.0 - 3.0 for two consecutive days, the use of low-molecular-weight heparin was discontinued and warfarin was taken orally alone, with INR regularly monitored to facilitate timely adjustment of the warfarin dosage. The treatment course of anticoagulation depended on the primary disease, usually with a period of 3 - 6 months. The observation group was treated with thrombolytic therapy and given a 50 mg dose of alteplase (Boehringer Ingelheim Pharmaceutical Co., Ltd., China Medicine Standard: S20110052) intravenously, and the pump was completed within 2 hours. After thrombolysis, the same anticoagulant treatment as that of the control group was performed.

Observation indicators

Clinical effect

- **Significantly effective:** Clinical symptoms such as chest pain and dyspnea had essentially disappeared, and the Cardiac Doppler ultrasound had shown marked improvement;
- **Effective:** The patient's chest pain, dyspnea and other clinical symptoms had eased, and the Cardiac Doppler ultrasound had

shown a > 50% decrease in the pulmonary embolism area;

- **Ineffective:** The patient's clinical symptoms had not relieved, and the Cardiac Doppler ultrasound had shown a < 50% decrease in the pulmonary embolism area;
- **Deteriorative:** Clinical symptoms had increased, and the Cardiac Doppler ultrasound had shown an increase in the pulmonary embolism area.

Blood gas analysis index and D-dimer level

Before and 24 hours after treatment, a blood gas analyzer was set up to monitor the arterial oxygen pressure (PO_2) and carbon dioxide partial pressure (PCO_2) levels of the two groups. Besides, the venous blood of the two groups was taken and centrifuged, then used an automatic analyzer to detect their D-dimer levels.

Bleeding status

The bleeding status of the two groups was recorded and the incidence was counted.

Recurrence rate

The patients were followed up for one year after discharge, and the recurrence of PTE was recorded.

Statistical methods

SPSS 22.0 statistical software was used for data analysis. The counting data were expressed as "n (%)" and analyzed with the χ^2 test. Measurement data were expressed as "± s" and analyzed with the t-test. When $P < 0.05$, the difference was statistically significant.

Results

Comparison of clinical efficacy between the two groups

The total clinical effective rate in the observation group was higher than that in the control group, and the difference was statistically significant ($P < 0.05$). The clinical efficacy is shown in table 1.

Group	Significant effect	Effective	Ineffective	Deterioration	Total efficiency
Observation group (n = 35)	14 (40.00)	18 (51.43)	2 (5.71)	1 (2.86)	32 (91.43)
Control group (n = 41)	10 (24.39)	19 (46.34)	7 (17.07)	5 (12.20)	29 (70.73)
χ^2					5.106
P					0.024

Table 1: *Comparison of clinical efficacy between the two groups n (%).*

Blood gas analysis and D-dimer level comparison between the two groups

There was no significant difference in the levels of PO_2, D-dimer and PCO_2 before and after treatment in the two groups ($P > 0.05$). After treatment, PO_2 and D-dimer levels in the two groups were higher than before treatment, and the observation group's levels were higher than that in the control group, with a statistically significant difference ($P < 0.05$). The blood gas analysis and D-dimer levels of the two groups are shown in table 2.

Group	PO_2 (mmHg)		PCO_2 (mmHg)		D-dimer (mg/L)	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Observation group (n = 35)	66.24 ± 6.85	81.26 ± 7.85[a]	31.28 ± 5.67	35.22 ± 4.31	2.13 ± 1.31	3.24 ± 0.82[a]
Control group (n = 41)	67.14 ± 7.31	71.36 ± 7.32[a]	32.18 ± 5.52	35.83 ± 5.47	2.09 ± 1.36	2.43 ± 1.45[a]
t	0.551	5.684	0.700	0.533	0.130	2.928
P	0.584	0.000	0.486	0.596	0.897	0.005

Table 2: *Comparison of blood gas analysis and D-dimer level between two groups (± s).*

Note: Compared with the same group before treatment respectively, [a]P < 0.05.

Comparison of bleeding between the two groups

Altogether, there was one case of hemoptysis and one case of gum bleeding in the control group, with a bleeding rate of 4.88% (2/41); three cases of hemoptysis, four cases of gum bleeding, and 6 cases of gross hematuria in the observation group, with a bleeding rate of 37.14% (13/35). There was a statistically significant difference in the incidence of bleeding between the two groups (χ^2 = 12.408, P = 0.000).

Comparison of recurrence rates between the two groups

Nine patients had recurrences in the control group, with a recurrence rate of 21.95% (9/41); the observation group had two recurrences with a recurrence rate of 5.71% (2/35). There was a statistically significant difference in the recurrence rate between the two groups (χ^2 = 4.021, P = 0.045).

Discussion and Conclusion

PTE's pathogenesis is complicated, and the disease itself is dangerous. It can rapidly block pulmonary arteries, obstruct pulmonary blood flow, promote the abnormal rise in pulmonary arterial pressure and increase right ventricular afterload, thereby expanding the right ventricle and leading to severe right ventricular dysfunction [5,6]. At the same time, when the right ventricle is under pressure, it will reduce the returning blood volume, thereby reducing cardiac output, affecting the body's circulating blood volume, causing hypotension symptoms and even resulting in shock, which seriously threatens patient lifespan [7]. According to relevant literature reports, high-risk PTE is often accompanied by high-risk dangers such as hypotension and cardiogenic shock, and patients have a high short-term mortality rate. Therefore, thrombolytic therapy should be given as soon as possible, and patients with low-risk PTE only require anticoagulation to improve their condition [8]. However, treatment is more controversial for patients with intermediate-risk, especially those with right ventricular dysfunction. Studies have shown that thrombolysis can quickly relieve pulmonary hemodynamics and improve survival. Despite this, some patients do not achieve good results after thrombolysis, and instead, their risk of bleeding is increased, thus aggravates their condition [9,10]. Therefore, the clinician should comprehensively analyze the patient's specific situation, physiological status, and risk of bleeding before conducting treatment.

Anticoagulation therapy can effectively prevent the formation and recurrence of thrombi, but it cannot directly dissolve existing thrombi. Nevertheless, anticoagulation is suitable for low-risk PTE patients with stable hemodynamics. Although patients with medium-to-high risk PTE have no immediate abnormal hemodynamic changes, they still need to be closely monitored because they have a higher risk of worsening their condition. Thrombolytic therapy can quickly dissolve thrombi existing in the pulmonary artery and accelerate the recovery of tissue blood perfusion, thereby improving clinical symptoms as soon as possible and preventing the disease from worsening. In this study's results, PO_2 and D-dimer levels in the observation group were higher than that of the control group after 24 hours of treatment, suggesting that thrombolytic therapy can quickly increase the partial pressure of arterial oxygen, relieve symptoms of dyspnea caused by

hypoxia, and reduce right ventricular afterload and pulmonary hypertension. Shannon M., *et al.* confirmed that both anticoagulation and thrombolysis could improve the clinical symptoms of patients. Still, the improvement effect of thrombolytic therapy is more significant for patients with medium-to-high risk PTE, which is substantially consistent with this study's results [11].

The reason is that thrombolytic therapy can quickly open blood vessels, improve pulmonary circulation perfusion, and reduce hypoxic damage. Despite this, thrombolytic therapy may increase the risk of bleeding and reduce the safety of the treatment. The results of this study also showed that the bleeding rate in the observation group was higher than that in the control group and that the observation group's recurrence rate was lower than that of the control group. Nevertheless, in this study, all patients had mild bleeding, no fatal bleeding symptoms, and all improved after symptomatic treatment. In addition, the long-term efficacy of thrombolytic therapy is better than anticoagulation therapy. The study by Hasan Allah Sadeghi., *et al.* showed that thrombolytic therapy could better improve right heart dysfunction and reduce long-term recurrence rate, which is similar to the results of this study [12].

In summary, both thrombolytic and anticoagulant treatments can improve vital signs in patients with acute medium-to-high risk PTE, but thrombolytic therapy is more effective, can increase PO_2 and D-dimer levels, will not increase the risk of fatal bleeding, and can also reduce recurrence and improve patient prognosis.

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Volume 9 Issue 3 March 2020