Clinical Value of Low Molecular Weight Heparin in Treatment of Pulmonary Heart Disease Complicated With Respiratory Failure

M. FAN, XIANGXIANG YANG, T. DING, Y. CAO, Q. SI, JING BAI, Y. LIN AND X. ZHAO[1*]

Department of Internal Medicine Cardiovascular, Pingliang People's Hospital, Pingliang, Gansu744000, China; [1]Department of Internal Medicine Cardiovascular, Affiliated Hospital of Gansu University of Traditional Chinese, No.1 Hezheng West Road, Chengguan District, Lanzhou, Gansu730020, China

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It is aimed to investigate the clinical value of low-molecular-weight heparin in treatment of pulmonary heart disease complicated with respiratory failure. Between January 2018 and April 2019, we included 120 pulmonary heart disease patients complicated with respiratory failure in this study and divided them into two groups using the double-blind, random method, i.e. the control group and the observation group, with 60 patients in each group. After admission, patients in two groups undertook the regular treatment, while those in the observation group additionally took low molecular weight heparin at 5000 U via subcutaneous injection, twice per d. Before and after treatment, arterial blood-gas indicators [partial pressure of carbon dioxide, partial pressure of oxygen and pH value] and the indicators of hemorheology (high blood viscosity, hematocrit and fibrinogen) and clinical efficacy were evaluated for patients in two groups. Prior to the treatment, comparison of the levels of partial pressure of carbon dioxide, partial pressure of oxygen, pH value, high blood viscosity, hematocrit and fibrinogen between two groups showed no significant differences, while after treatment, significant improvement was demonstrated in these indicators in the observation group as compared to those in the control group ($p<0.05$), but the difference in pH value showed no statistical significance ($p>0.05$). In the observation group, patients had an effectiveness rate of 88.33 % (53/60), significantly higher than 63.33 % (38/60) in the control group ($p<0.05$). Comparison of the time of oxygen uptake and incidence rate of complications showed no significant differences ($p>0.05$), while patients in the observation group had shorter hospitalization time [(14.7±0.4) d] than that [(16.9±0.3) d] in the control group ($p<0.05$). For pulmonary heart disease patients complicated with respiratory failure, medication of low-molecular-weight heparin gained promising efficacy, with significant improvement in the blood performance, ventilation, and heart and lung functions of patients, thereby increasing the survival rate and shortening the hospitalization time of patients. Thus, it is worthy of being promoted in clinical practice.

Key words: Pulmonary heart disease, hematocrit, heparin, low-molecular-weight, survival rate, blood gas analysis, respiratory insufficiency.

Pulmonary heart disease (PHD), also known as cor pulmonale, is a kind of chronic, hypoxic disease that causes massive retention of Carbon dioxide (CO_2), with the symptoms of respiratory failure, severely torturing the patients, with a high mortality rate. After the respiratory failure, appropriate, in-time treatment could curb the progression of disease and reduce the mortality rate[1,2]. For PHD complicated with respiratory failure, treatment is carried out via the cardiotonic, uretic drugs, spasmolytics and oxygen uptake. As evidenced by the current study, PHD patients in the decompensation period of lung or heart function usually are in the highly coagulative status of lung circulation or have the formation of primary microthrombus, which could be rectified by the medication of low-molecular-weight heparin (LMWH)[3]. Thus, between January 2018 and April 2019, we included 120 PHD patients complicated with respiratory failure in this study and divided them into two groups using the double-blind, random method, i.e. the control group and the observation group, with 60 patients in each group, to investigate the clinical value of LMWH in treatment of PHD complicated with

***Address for correspondence**
E-mail: bw4qsu@163.com

respiratory failure. Between January 2018 and April 2019, we included 120 PHD patients complicated with respiratory failure in this study and divided them into two groups using the double-blind, random method, i.e. the control group and the observation group, with 60 patients in each group. This study had been approved by the Ethical Board of Pingliang People's Hospital and gained the written approval from the subjects who had been informed of the content of this study. In the control group, there were 34 males and 26 females, aged between 51 and 84 y old, with an average age of (60.20±8.52) y old; as for the fundamental diseases, there were 7 patients with bronchial asthma, 9 with bronchial dilation and 44 with chronic obstructive pulmonary disease; besides, for patients in the control group, the average of left ventricular ejection fraction (LVEF) was (57±5) %, the average of right ventricular internal dimension was (28±7) mm, the average of partial pressure of carbon dioxide ($PaCO_2$) was (59.86±11.02) mmHg, the average of partial pressure of oxygen (PaO_2) was (48.60±9.37) mmHg, and the average of pH value was (7.34±0.11). In the observation group, there were 36 males and 24 females, aged between 52 and 83 y old, with an average age of (61.09±7.66) y old; as for the fundamental diseases, there were 9 patients with bronchial asthma, 12 with bronchial dilation and 32 with chronic obstructive pulmonary disease; besides, for patients in the control group, the average of LVEF was (56±7) %, the average of right ventricular internal dimension was (27±8) mm, the average of $PaCO_2$ was (61.86±8.10) mmHg, the average of PaO_2 was (48.37±7.52) mmHg, and the average of pH value was (7.22±0.02). Comparison of the clinical data of patients between two groups showed no significant differences. All patients conformed to the diagnostic criteria for chronic PHD[4] stipulated by Pulmonary Heart Disease Association of China in 1980 and that for the Type II respiratory failure and received the blood-gas analysis for confirmation. Patients with metabolic acidosis, diabetes mellitus, cerebral infarction, heart diseases, or the history of medication of anticoagulative drugs or antithrombotic drugs within 14 d prior to admission were excluded from this study. Following the admission, patients in two groups received the regular treatment, including the anti-inflammation and anti-infection therapy, supplemented with the treatment for bronchodilation, diuresis, cardiotonic support or if necessary, the continuous low-flow oxygen uptake. For patients in the observation group, they would additionally take the subcutaneous injection of 5000 U of LMWH, twice a d, for 1 w. During the treatment, all patients should be monitored closely via the following aspects: vital signs, improvement in existing symptoms like pulmonary rales, edema and dyspnea; for those with no improvement, adjustment of therapy should be considered immediately. Before and after treatment, arterial blood-gas indicators [partial pressure of carbon dioxide ($PaCO_2$), partial pressure of oxygen (PaO_2) and pH value] were evaluated for patients in two groups. For patients in two groups, changes in pulmonary rales and edema, heart rate, cyanosis and asthma were observed and recorded for evaluation of criteria[5]: Remission: Heart rate<100 beats/min, disappearance of pulmonary rales, alleviation of cyanosis and significant improvement or disappearance of the asthma and edema; Alleviation: Heart rate<100 beats/min, disappearance of pulmonary rales, slight alleviation in cyanosis and slight improvement in the asthma and edema; Failure: Heart rate>100 beats/min, no improvement or even deterioration of pulmonary rales, cyanosis, asthma and edema; Death. The time of oxygen uptake, incidence rate of complications and hospitalization time of patients in two groups were recorded. SPSS 22.0 software was utilized to analyze the data of this study. Measurement data were compared by using the t test, while the enumeration data by using the chi-square test. $p<0.05$ suggested that the difference had statistical significance. Before treatment, patients in two groups had no significant difference in comparison of the levels of $PaCO_2$, PaO_2 and pH value ($p>0.05$), while after treatment, significant improvement was observed in the levels of $PaCO_2$ and PaO_2 in the observation group ($p<0.05$), but the difference in pH value had no statistical significance ($p>0.05$; Table 1). Before treatment, comparison of the levels of high blood viscosity, hematocrit and fibrinogen between two groups showed no significant differences ($p>0.05$), while after treatment, significant improvement was shown in the observation group, instead of control group ($p<0.05$; Table 2). In the observation group, patients had an effectiveness rate of 88.33 % (53/60), significantly higher than 63.33 % (38/60) in the control group ($p<0.05$; Table 3). Comparison of the time of oxygen uptake and incidence rate of complications showed no significant differences ($p>0.05$), while patients in the observation group had shorter hospitalization time [(14.7±0.4) d] than that [(16.9±0.3) d] in the control group ($p<0.05$; Table 4).

TABLE 1: COMPARISON OF THE CHANGES IN THE ARTERIAL BLOOD-GAS INDICATORS BEFORE AND AFTER TREATMENT BETWEEN TWO GROUPS (MEAN±SD, n=60)

Group	Time	$PaCO_2$(mmHg)	PaO_2(mmHg)	pH value
Observation group	Before treatment	61.86±8.10	48.37±7.52	7.22±0.02
	After treatment	58.52±18.31[ab]	61.58±1.84[ab]	7.32±0.02
Control group	Before treatment	59.86±11.02	48.60±9.37	7.34±0.11
	After treatment	78.18±14.57b	53.00±4.55	7.34±0.08

Note: [a]p<0.05 vs. the control group; [b]p<0.05 vs. the level before treatment in the same group.

TABLE 2: COMPARISON OF THE CHANGES IN THE INDICATORS OF HEMORHEOLOGY IN TWO GROUPS BEFORE AND AFTER TREATMENT (MEAN±SD, n=60)

Group	Time	High blood viscosity (mPa•s)	Hematocrit (%)	Fibrinogen (g/L)
Observation group	Before treatment	9.88±0.81	0.66±0.07	5.11±1.01
	After treatment	5.44±0.03[ab]	0.44±0.06[ab]	3.22±1.14[ab]
Control group	Before treatment	9.64±0.98	0.64±0.06	5.13±1.26
	After treatment	8.95±0.91b	0.61±0.07	4.77±1.64

Note: [a]p<0.05 vs. the control group; [b]p<0.05 vs. the level before treatment in the same group.

TABLE 3: COMPARISON OF THE CLINICAL EFFICACY BETWEEN TWO GROUPS (n=60)

Group	Remission	Alleviation	Death	Effectiveness rate [n (%)]
Observation group	37	16	2	53(88.33)
Control group	25	13	10	38(63.33)
p				<0.05

p<0.05 indicated the statistical significance of the difference.

TABLE 4: COMPARISON OF THE PROGNOSIS OF PATIENTS BETWEEN TWO GROUPS (n=60)

Group	Oxygen uptake (d)	Complications [n (%)]	Hospitalization time (d)
Observation group	3.2±0.1	2(3.3)	14.7±0.4
Control group	3.3±0.4	3(5.0)	16.9±0.3
p	>0.05	>0.05	<0.05

$\bar{x}\pm s$= means ± standard deviation, p<0.05 indicated the statistical significance of the difference.

Clinically, PHD is mainly caused by the hypoxemia contributed by the sharp decrease in the ability of lung in gas exchange due to the anomaly in pulmonary vessels, damage to the pulmonary parenchyma and obstruction of peripheral airway, and the remodeling of pulmonary circulation in the advanced COPD patients. In the acute phase, most of the PHD patients would have complication of Type II respiratory failure, and in the long-term hypoxic status, hypercapnia can injure the vascular endothelium, thereby inducing the stagnation in microcirculation and the secondary augmentation of erythrocyte, with the symptoms of infection, finally initiating the early stage of thrombosis[6,7]. Existing studies have shown that in patients dying of the chronic PHD in the acute phase, primary thrombus in the pulmonary arteriole could be detected in 90 % of them or so, while the further detection demonstrated no signs of thrombosis, suggesting that this sign could be used as the evident pathological feature for the chronic PHD patients in the acute phase[8]. For treatment of these patients, symptomatic treatment includes the maintenance of water electrolyte balance, nutrition support, anti-infection therapy, spasmolytic treatment and low-flow continuous oxygen uptake, and in addition, focus in treatment should also shifted to the management of hyper viscosity[8]. Modern pharmacological evidence has shown that in the treatment of PHD patients in acute phase, LMWH could interact with the antithrombin III and its complex, thereby curbing the activity of antithrombin and X factor, and antagonizing the thrombosis. Besides, LMWH is featured by the anti-inflammation effect, anti-

allergy effect, and the abilities to decrease the viscosity of sputum and blood, improve the bronchial spasm, dilate the coronary artery and decrease the pulmonary arterial pressure. Thus, LMWH is available for patients with the polycythemia or dehydration, regardless of the thrombosis[9,10]. In addition to the regular treatment, LWMH could further improve the efficacy of treatment. In this study, prior to the treatment, comparison of the levels of $PaCO_2$, PaO_2, pH value, high blood viscosity, hematocrit and fibrinogen between two groups showed no significant differences, while after treatment, significant improvement was demonstrated in these indicators in the observation group as compared to those in the control group ($p<0.05$), but the difference in pH value showed no statistical significance ($p>0.05$). Results above are similar to the previously published reports[11], suggesting that LMWH could further improve the indicators of hemorheology and arterial blood-gas indicators, thereby mitigating the blood status and ventilation of patients. In the observation group, patients had an effectiveness rate of 88.33 % (53/60), significantly higher than 63.33 % (38/60) in the control group ($p<0.05$). Comparison of the time of oxygen uptake and incidence rate of complications showed no significant differences ($p>0.05$), while patients in the observation group had shorter hospitalization time [(14.7±0.4) d] than that [(16.9±0.3) d] in the control group ($p<0.05$), consistent to those reported in the existing literatures[12]. Results in this study showed that LMWH could improve the symptoms of patients, like pulmonary rales and edema, heart rate, cyanosis and asthma, thereby shortening the hospitalization time of patients. Hence, for PHD patients complicated with respiratory failure, LMWH manifests the significant clinical value. In summary, for PHD patients complicated with respiratory failure, medication of LMWH gained promising efficacy, with significant improvement in the blood performance, ventilation, and heart and lung functions of patients, thereby increasing the survival rate and shortening the hospitalization time of patients. Thus, it is worthy of being promoted in clinical practice.

Author's contributions:

Mingqiang Fan and Xiangxiang Yang contributed equally to this work.

Conflicts of Interest:

The authors declared no conflicts of interest.

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