

Clinical effect of simvastatin combined with exercise training in the treatment of stationary chronic obstructive pulmonary disease complicated with metabolic syndrome

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Abstract: The aim of this study is to observe and analyze the clinical efficacy of simvastatin combined with exercise training in the treatment of stationary chronic obstructive pulmonary disease complicated with metabolic syndrome. In this study, 180 patients who had been treated for stable chronic obstructive pulmonary disease (COPD) complicated with metabolic syndrome in our hospital were enrolled as research objects. The selected patients were randomly divided into research group receiving simvastatin combined with exercise training and control group accepting routine therapy, each containing 90 cases. The therapeutic effects of the two groups were compared. The CAT score, insulin resistance index and 6 min walking distance of the two groups were compared. The results showed that compared with the control group, the improvement effect of the research group was more obvious, and the effect was better than that of the control group, $p < 0.05$. The levels of IL-6 (interleukin-6), IL-8 (interleukin-8) and other inflammatory factors were significantly lower in the research group than those in the control group, $p < 0.05$. Simvastatin combined with exercise training in the treatment of stationary chronic obstructive pulmonary disease with metabolic syndrome is an effective treatment, which can significantly improve the treatment effect and help patients to achieve a higher quality of life.

Keywords: Simvastatin, exercise training, stable stage, chronic obstructive pulmonary disease, metabolic syndrome.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a type of chronic bronchitis and/or emphysema characterized by a sudden flow of air, which can lead to pulmonary heart disease and respiratory failure. COPD is associated with abnormal inflammatory reactions of harmful gases and harmful particles, with a high disability rate and mortality rate. The worldwide incidence of COPD is as high as 9% ~ 10% among people over 40 years old (Zhang, 2017). COPD is a common preventable and treatable disease characterized by continuous airflow limitation, which is associated with increased chronic inflammatory responses of the airways and lungs to toxic particles or gases. Metabolic syndrome refers to the pathological state of metabolic disorders of proteins, fats, carbohydrates and other substances in the human body. It is a complex metabolic disorder syndrome and a risk factor leading to cardiovascular and cerebrovascular diseases of diabetes (Jiang and Zhang, 2018; Wu, 2018). The etiology of metabolic syndrome is not clear yet, but is currently thought to be the result of interactions between multiple genes and multiple environments, and related to heredity and immunity. This disease is affected by many environmental factors, including high-fat and high-carbohydrate diet, low labor intensity and little exercise, which increases the occurrence of insulin resistance, and causes the occurrence and development of metabolic syndrome.

Patients having COPD complicated with metabolic syndrome (as shown in fig. 1) will present clinical symptoms such as restricted movement and dyspnea and also have complex metabolic disorders such as insulin resistance, which may affect the quality of life of patients and even threaten their life (Liu *et al.*, 2017; Shen, *et al.*, 2017). Timely and effective drug therapy is an important way to improve the treatment effect. In this study, the clinical efficacy of simvastatin combined with exercise training in the treatment of stationary chronic obstructive pulmonary disease with metabolic syndrome was investigated.

MATERIALS AND METHOD

In this study, 180 patients who had been treated for stable COPD complicated with metabolic syndrome in our hospital from May 2016 to May 2019 were enrolled as research objects. All the patients were clearly diagnosed by comprehensive clinical examination. Patients meeting inclusion criteria are those meeting the (2011) global strategy diagnostic criteria for COPD and the international diabetes (2005) diagnostic criteria for metabolic syndrome and showing varying degrees of dyspnea, wheezing and other symptoms. In contrast, patients with other respiratory diseases, severe dysfunction of heart and kidney and other important organs and those who have recently taken statins and cannot tolerate such drugs were excluded.

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Patients and their families had the right to know and signed the informed consent. The study was approved by the Ethical Committee. The selected patients were randomly divided into two control group and research group, each containing 90 cases. There were 50 male patients and 40 female patients in the study group, respectively, with an average age of (66.7±2.1) years old. There were 48 male patients and 42 female patients in the reference group, respectively, with an average age of (67.3±2.8) years old. There were no significant differences in general data between two groups before treatment, $p>0.05$.

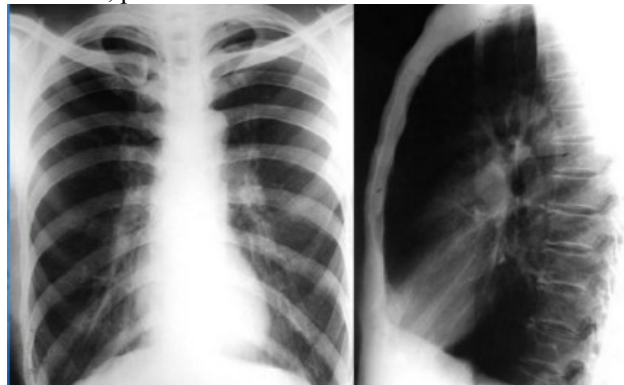


Fig. 1: Examination chart of stable COPD with metabolic syndrome

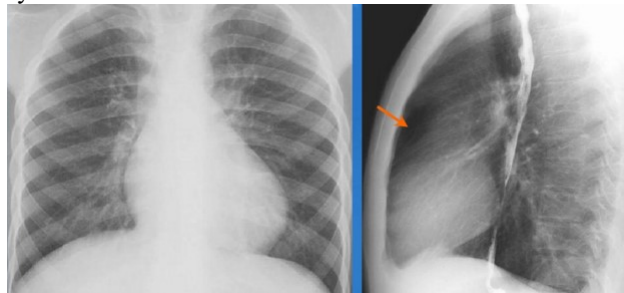


Fig. 2: Imaging examination before treatment

Patients in the control group were given conventional treatment mode, namely, comprehensive treatment including oxygen inhalation, mechanical ventilation, anti-asthma, expectoration, electrolyte balance correction, and anti-infection. On the basis of conventional treatment, simvastatin combined with exercise training was implemented in the research group. Simvastatin (MSD Pharmaceutical Co., Ltd., SFDA approval number J20010323) was taken orally, once a day, each time 20 mg. Simvastatin molecular formula is $C_{25}H_{38}O_5$, molecular weight is 418.56600, precise mass is 418.27200. Simvastatin can reduce cholesterol, low density lipoprotein cholesterol and extremely low density lipoprotein cholesterol.

Regarding exercise training, breathing exercises is the step. Patients were instructed to take abdominal breathing, lip constriction breathing and other breathing movements, each time lasting 20 minutes, each movement for 5 times; Next, upper body exercises, including performing upper

extremity pull exercises, raising client's arms and ensuring elbows are straight. Then, leg exercises. Let the patient sit on the bed or chair, straighten the knee joint, and raise the lower limb on the same side. After 5s of continuous elevation, repeat the above actions for the lower limb on the other side and stop the pulling sensation behind the thigh. Finally, squats exercise. Use walls for upper-body squats that are straight, making sure the legs are flat to the floor. During exercise training, the amount of exercise and the range of motion should be adjusted reasonably according to the actual tolerance of patients and carried out five times a week (Wang, *et al.*, 2018a).

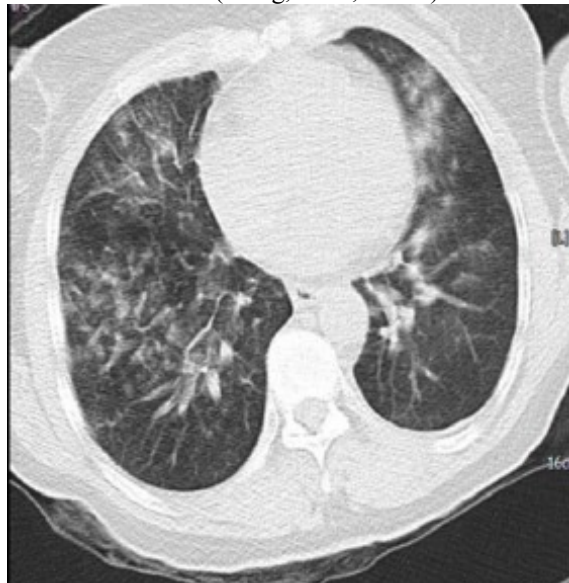


Fig. 3: Pulmonary conditions before treatment



Fig. 4: Pulmonary conditions after treatment

Observation indicators

Before and after treatment, the COPD status questionnaire (CAT score), lung function (FEV1, FEV1/ FVC%), peripheral blood inflammatory factor levels (IL-6, IL-8, CRP, TNF- α) were statistically analyzed, and the insulin resistance and 6 min walking distance after treatment

Table 1: Changes of pulmonary function and CAT score before and after treatment in the two groups ($\bar{x}\pm s$)

Group	FEV1 (L)		FEV1/FVC (%)		CAT	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Research group	1.4±0.2	1.9±0.5	62.39±10.28	74.55±13.20	25.13±1.24	22.59±1.33
Control group	1.4±0.7	1.5±0.3	62.93±9.36	65.80±12.37	25.90±2.15	24.24±2.02
t	0.29	4.59	0.20	5.32	0.94	8.61
p	>0.05	<0.05	>0.05	<0.05	>0.05	<0.05

Table 2: Changes of inflammatory factors in peripheral blood of the two groups ($\bar{x}\pm s$)

Group	IL-6 (ng/ml)		IL-8 (ng/ml)		CRP (mg/L)		TNF- α (ng/L)	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Research group	190.3±2.2	66.9±2.5	212.67±3.2	88.9±3.3	5.1±1.2	2.5±0.3	166.8±2.1	54.3±2.3
Control group	190.4±2.7	152.96±10.3	213.9±4.0	160.8±4.3	5.4±1.1	3.8±0.5	168.7±2.3	136.0±2.9
t	0.60	6.55	0.22	5.39	0.82	6.44	0.10	8.93
p	>0.05	<0.05	>0.05	<0.05	>0.05	<0.05	>0.05	<0.05

Table 3: Comparison of MMCR (Medical Research Council Scale) scores and 6MWD (6-min Walking Distance) after treatment between the two groups ($\bar{x}\pm s$)

Group	Number of cases	mMCR score (point)	6MWD (m)
Research group	90	0.92±1.22	360.16±60.15
Control group	90	2.46±1.20	270.44±50.83
t		5.32	5.91
p		<0.05	<0.05

were observed. CAT score was used to evaluate the quality of life of patients in the Chinese version of CAT, including sleep, cough, chest tightness and other items (Wang, *et al.*, 2018b). The total score is 40 points and each item is 0-5 points. 0-10 points is considered slight affected; 11-20 points is considered moderately affected; 21-30 points is considered severely affected; 31-40 points is considered heavily affected. A modified medical research council scale (mMRC) was also used to assess the degree of dyspnea.

Ethical approval

Patients and their families had the right to know and signed the informed consent. The study was approved by the Ethical Committee.

STATISTICAL ANALYSIS

Statistical analysis software SPSS21.0 was used to process data. The measurement data were expressed by mean \pm standard deviation ($\bar{x}\pm s$), with t test conducted for intergroup comparison. Enumeration data were expressed by natural (n) and percentage (%), with Chi-square used for intergroup comparison. The intergroup difference was considered statistically significant when $p<0.05$.

RESULTS

Changes of pulmonary function and CAT score before and after treatment in the two groups

As shown in table 1, the improvement of lung function and CAT score in the study group was significantly higher than that in the control group, $p<0.05$.

Changes of inflammatory factors in peripheral blood of the two groups

As shown in table 2, the improvement of various indicators in the research group was significantly better than that in the control group, $p<0.05$.

Comparison of MMCR (Medical Research Council Scale) scores and 6MWD (6-min Walking Distance) after treatment between the two groups

As shown in table 3 below, all indexes of the research group were significantly better than those of the control group after treatment, $p<0.05$.

DISCUSSION

The progression of COPD and metabolic syndrome is an interactive process closely related to the high plasma levels of various inflammatory cytokines. COPD may involve chronic inflammation and systemic inflammation as well. How to actively improve the symptoms and improve the life quality of patients with stationary copd with metabolic syndrome is particularly critical (Zheng *et al.*, 2018). Statins are hydroxymethyl-glutaryl coenzyme A inhibitors, which produce anti-inflammatory, antioxidant and anticoagulant effects, and play a role in regulating the immune function of the body, so they have a better application effect in the treatment of atherosclerosis (Lu *et al.*, 2018; Fang, Zheng and Zhang, 2018).

Statins such as simvastatin are widely used in the treatment of stationary chronic obstructive pulmonary

disease with metabolic syndrome, which can reduce the level of related inflammatory factors and produce ideal anti-inflammatory effect. Meanwhile, simvastatin can improve the anti-inflammatory effect of glucocorticoids, reduce the number of acute attacks in patients with COPD, and thus control the clinical symptoms of patients with COPD. In addition, statins have a significant effect on lipid reduction and are ideal for the treatment of metabolic syndrome. The results of this study showed that after simvastatin treatment, the insulin resistance index of the research group was significantly lower than that of the control group, and the levels of IL-6, IL-8, CRP and TNF- α inflammatory factors in the peripheral blood of the research group were significantly lower than that of the control group, $p < 0.05$. Therefore, simvastatin has an excellent anti-inflammatory effect and can produce a favorable effect on the metabolism of the body.

Through applying exercise training treatment model to stationary chronic obstructive pulmonary disease with metabolic syndrome, the physical quality, contraction function of respiratory muscles and body resistance of patients could be improved. Through chest exercise, the sputum capacity and breathing efficiency of patients could be improved. Through the practice of upper limbs, lower limbs and squat training, patients' limb mobility ability is enhanced, so that they can carry out daily life and work faster and improve the quality of life. The results of this study showed that after the exercise training treatment, the 6 min walking distance of patients in research group was significantly higher than that of the control group, and their CAT score was higher than that of the control group. Therefore, simvastatin combined with exercise training can effectively improve the pulmonary function of patients with COPD complicated with metabolic syndrome, reduce their CAT score and improve their min walking distance, so as to actively improve the quality of life of patients and achieve better results.

CONCLUSION

In summary, about 40% of COPD patients have metabolic syndrome, which seriously affects the health of patients. Simvastatin is a common statin drug, which has the functions of lipid regulation, anti-inflammatory, antioxidant and antithrombotic and also exerts the role of repairing vascular endothelial cells. Simvastatin is used in inflammatory airway disease to relieve symptoms and improve prognosis. Respiratory exercise training is to exercise the respiratory function of patients, and increase the strength of respiratory muscle in a step-by-step way, so as to improve the lung function of patients. For patients with stable COPD and metabolic syndrome, the implementation of simvastatin with exercise training can actively improve the patient's clinical symptoms, adjust the patients' lung function, lower levels of peripheral blood, effectively enhance exercise ability, and improve

the CAT scores, reduce insulin resistance, which is very important to improve patients' quality of life. Therefore, such treatment mode can be widely used in clinic.

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