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Original Article

Effects of rehabilitation training on quality of life, motor function, and pulmonary function in patients with chronic obstructive pulmonary disease in the stable phase

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Abstract: Objective: The aim of the current study was to investigate the curative effects of erector spinae functional rehabilitation training on postoperative inflammation of osteoporotic vertebral compressive fractures, as well as the effects on quality of life, motor function, and pulmonary function, in patients with chronic obstructive pulmonary disease (COPD) in the stable phase. Methods: A total of 80 patients with COPD in the stable phase, hospitalized from January 2017 to October 2017, meeting inclusion criteria, were collected and randomly divided into the rehabilitation treatment group (n=40) and traditional treatment group (n=40). After admission, patients in the traditional treatment group received traditional treatment, while patients in the rehabilitation treatment group received rehabilitation training based on traditional treatment. All patients were followed up for 6 months after treatment. UK Medical Research Council (MRC) dyspnea scores, forced expiratory volume in 1 second (FEV1), 6-minute walking distances (6MWD), body mass index, airflow obstruction, dyspnea and exercise capacity index (BODE index) scores, Borg scores, St George's respiratory questionnaire (SGRQ) scores, Hamilton anxiety scale (HAMA) scores, Hamilton depression scale (HAMD) scores, and body mass index (BMI) were recorded. Expression levels of inflammatory factors were detected using enzyme-linked immunosorbent assay (ELISA). Correlation levels of motor function with myodystrophy were explored using Pearson's correlation coefficient analysis. Results: Compared to before treatment, MRC, BODE, Borg, HAMA, HAMD, and SGRQ scores in the rehabilitation treatment group decreased significantly after treatment, with statistical elevation in FEV1, 6MWD, BMI, IL-1, and IL-6 (P<0.05). Compared with the traditional treatment group, MRC, BODE, Borg, HAMA, HAMD, and SGRQ scores in the rehabilitation treatment group decreased significantly after treatment. Levels of FEV1, 6MWD, BMI, IL-1, and IL-6 were statistically upregulated (P<0.05). Motor function was positively correlated with myodystrophy in patients with COPD. Conclusion: Rehabilitation training is effective for treatment of COPD in the stable phase, improving pulmonary function, motor function, and quality of life. Therefore, it is worthy of clinical popularization and application.

Keywords: Chronic obstructive pulmonary disease, rehabilitation training, pulmonary function, motor function, quality of life

Introduction

Chronic obstructive pulmonary disease (COPD) is a common clinical disease of the respiratory system [1]. Patients often suffer from continuous obstruction of air flow. COPD is featured by irreversible and continuous obstruction of air flow, rapid progression of the disease, and a progressive course, with high morbidity and mortality rates. COPD often causes death, seriously impacting patient living and motor abilities and leading to a heavy burden on families and society [2]. Drugs and proper rehabilitation training are critical for treatment of COPD in the stable phase. An increasing number of clinical medical workers are aware that rehabilitation training contributes to treatment of patients with COPD in the stable phase. It can remarkably improve pulmonary function, motor function, and quality of life. Therefore, the current study aimed to further elucidate the effects of rehabilitation training on quality of life, pulmonary function, and motor function in patients with COPD in the stable phase.

Patients and methods

General data

A total of 80 patients with COPD in the stable phase, hospitalized from January 2017 to October 2017, were enrolled and randomly divided into the rehabilitation treatment group (n=40) and traditional treatment group (n=40). The rehabilitation treatment group included 19 males and 21 females, aged 65.67±5.27 years, with a disease duration of 12.33±4.87 years. The traditional treatment group included 17 males and 23 females, aged of 68.56±4.38 years, with a disease duration of 13.56±3.88 years. There were no differences in gender, age, and course of disease between the two groups (P>0.05), indicating comparability.

Diagnostic criteria

For the current study, the *Guidelines for Diagnosis and Treatment of Chronic Obstructive Pulmonary Disease,* formulated by Chronic Obstructive Pulmonary Disease Group of Respiratory Society, Chinese Medical Association, was taken as diagnostic criteria.

Inclusion criteria: 1) Patients meeting the above diagnosis criteria of COPD in the stable phase; 2) Patients that only received drug treatment recently; 3) Patients that agreed to participate in the study and provided informed consent; and 4) Patients that volunteered to follow the doctor's advice and cooperate with treatment.

Exclusion criteria: 1) Patients not meeting the above inclusion criteria; 2) Patients complicated with serious internal medicine diseases, such as hypertension, diabetes, and heart disease; and 3) Patients with a medical history of severe primary diseases or critical diseases, such as mental disease.

Methods

Research design

Randomized controlled clinical trials were performed in the current study.

Random methods

A random number table was generated using Excel software, based on subjects randomly divided into the rehabilitation therapy group (n=40) and traditional therapy group (n=40). Serial numbers, groups, and random numbers of patients were sealed in an opaque envelope. They were preserved by full-time personnel that were not researchers in this study.

Treatment methods

Traditional treatment methods: Patients in the traditional therapy group were treated with traditional treatment methods and received routine drugs, including phlegm-expelling drugs and bronchodilator. Patients with severe coughs appropriately received glucocorticoid therapy or immunomodulator therapy.

Rehabilitation training methods: In addition to traditional drug therapy, patients in the rehabilitation therapy group underwent rehabilitation training. Specific methods of rehabilitation training are as follows: Upper limbs were trained using a non-resistance hand trolley at a rate of 50 rpm once per day (30 minutes per time). Patients walked for aerobic training of the lower limbs once per day (1 hour per time). Muscular strength of the lower limbs was tested via circuit anti-resistance training once every other day (20 minutes per time). The rehabilitation therapist pressed the patient's lower chest wall or chest back with the palms. The therapist asked the patients to inhale deeply to expand the chest wall against resistance for 20 minutes per day. Respiratory function retraining was performed via abdominal breathing, mouth-shrinking breathing, and assisted breathing. Specific methods of abdominal breathing are as follows: In a supine position, the patient, with his/her left hand on the chest and right hand on the upper abdomen, inhaled to bulge the abdomen. The patient lifted the right hand with the abdomen bulges, while exhaling to retract the abdomen. The right hand pressed the chest and back slightly hard to help recover the abdominal muscle. Specific methods of mouth-shrinking breathing are as follows: The patient inhaled with the nose, then slowly exhaled in a mouth-shrinking and cheek-bulging form. The inspiratory-expiratory time ratio was controlled at 2:4.

Evaluation indexes

After 6 months of treatment, patient lung function was evaluated using the UK Medical Research Council (MRC) dyspnea index and forced

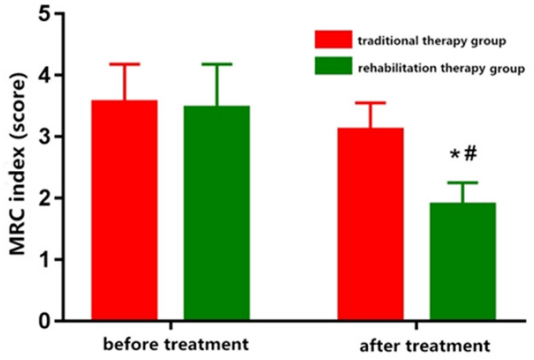

Figure 1. MRC index. Note: *P<0.05 vs. before treatment, #P<0.05 vs. traditional therapy group.

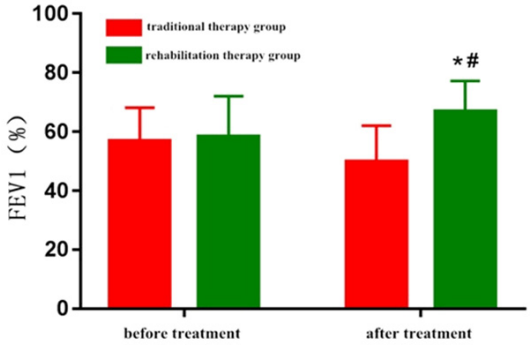

Figure 2. FEV1. Note: *P<0.05 vs. before treatment, #P<0.05 vs. traditional therapy group.

expiratory volume in 1 second (FEV1). Patient motor function was evaluated via 6-minute walking distances (6MWD). Body mass index, airflow obstruction, dyspnea, and exercise capacity (BODE) indexes were used to assess progression of the disease. The Borg rating of perceived exertion was applied to assess daily living abilities. Moreover, patient quality of life was evaluated using the St George's Respiratory Questionnaire (SGRQ), Hamilton Anxiety Scale (HAMA), and Hamilton depression scale (HAMD).

Statistical methods

Statistical Product and Service Solutions (SPSS) 20.0 software was adopted for statistical analysis. Enumeration data are presented as mean ± standard deviation. Student's *t*-tests were employed for data in line with normal distribution and homogeneity of variance. Corrected *t*-tests were conducted for data in line with normal distribution and heterogeneity of variance. Non-parametric tests were used for data not in line with normal distribution and homogeneity of variance. Rank-sum tests were adopted for ranked data and Chi-square tests were adopted for enumeration data. P<0.05 suggests that differences are statistically significant.

Results

Rehabilitation training reduced MRC dyspnea index

Compared to before treatment, the MRC dyspnea index of patients in the rehabilitation therapy group was significantly reduced after treatment (P<0.05). The MRC dyspnea index in the rehabilitation therapy group also remarkably declined after treatment, compared with that in the traditional therapy group (P<0.05). Results suggest that rehabilitation training can significantly improve symptoms of dyspnea in COPD patients (**Figure 1**).

Rehabilitation training elevated FEV1

Compared to before treatment, FEV1 levels in the rehabilitation therapy group were notably increased after treatment (P<0.05). FEV1 levels in the rehabilitation therapy group were also significantly increased after treatment, compared with levels in the traditional therapy group (P<0.05). Results suggest that rehabilitation training can significantly elevate FEV1 levels of COPD patients (**Figure 2**).

Rehabilitation training increased 6MWD

In the current study, 6MWDs of patients in both groups were markedly increased after treatment, compared with levels before treatment (P<0.05). Moreover, 6MWDs in the rehabilitation therapy group were significantly increased after treatment, compared with those in the traditional therapy group (P<0.05), suggesting that both traditional therapy and rehabilitation training can significantly improve motor function in COPD patients. The latter, however, is significantly superior to the former in improving motor function in COPD patients (**Figure 3**).

Rehabilitation training results in decline of BODE scores

BODE score of patients in both groups were significantly downregulated after treatment. compared with scores before treatment (P<0.05). BODE scores in the rehabilitation therapy group

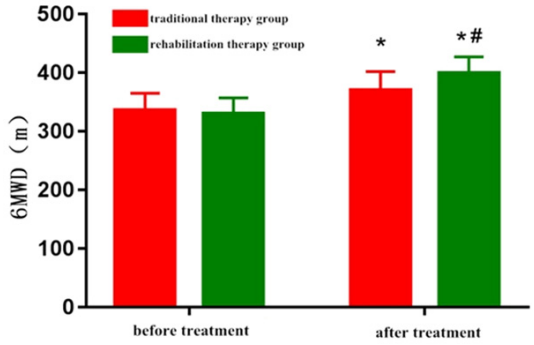

Figure 3. 6MWD. Note: *P<0.05 vs. before treatment, #P<0.05 vs. traditional therapy group.

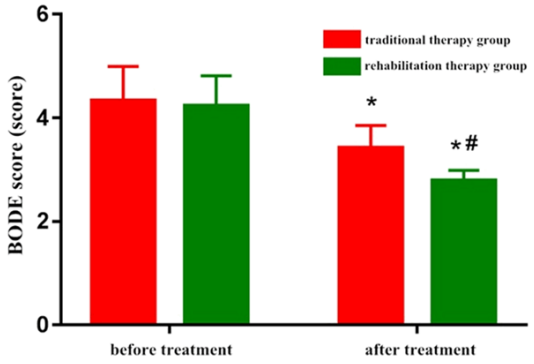

Figure 4. BODE scores. Note: *P<0.05 vs. before treatment, #P<0.05 vs. traditional therapy group.

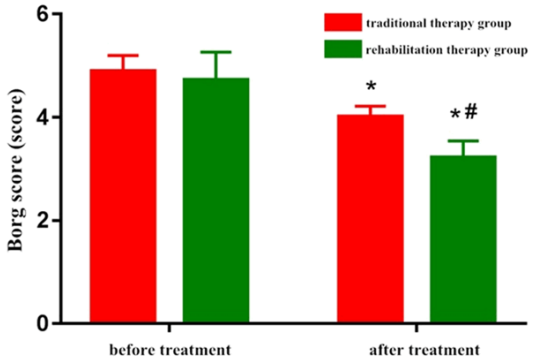

Figure 5. Borg scores. Note: *P<0.05 vs. before treatment, #P<0.05 vs. traditional therapy group.

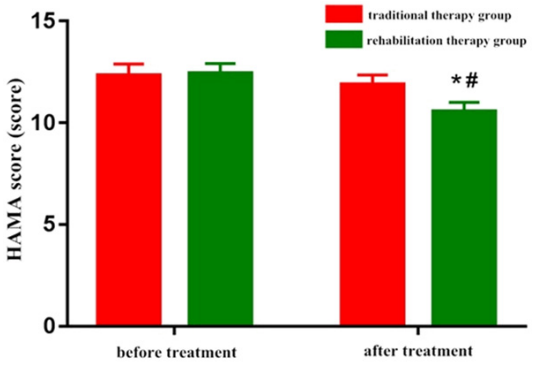

Figure 6. HAMA scores.

significantly declined after treatment, compared with those in the traditional therapy group (P<0.05). Data suggests that rehabilitation training can even further improve conditions of COPD patients (**Figure 4**).

Rehabilitation training decreases Borg scores

Borg scores of patients in both groups were remarkably decreased after treatment, compared with scores before treatment (P<0.05). Also, Borg scores in the rehabilitation therapy group were significantly decreased after treatment, compared with scores in the traditional therapy group (P<0.05), indicating that both rehabilitation training can favor the effects of traditional therapy for perceived exertion of COPD patients (**Figure 5**).

Rehabilitation training lowers HAMA and HAMD scores

Compared with levels before treatment, both HAMA scores and HAMD scores of patients in the rehabilitation therapy group were significantly reduced after treatment (P<0.05). Compared with scores in the traditional therapy group, HAMA scores and HAMD scores in the rehabilitation therapy group were noticeably reduced after treatment (P<0.05), suggesting that rehabilitation training can significantly improve depression and anxiety symptoms of COPD patients (**Figures 6**, **7**).

Rehabilitation training reduces SGRQ scores

Compared to before treatment, SGRQ scores of patients in the rehabilitation therapy group were significantly reduced after treatment (P< 0.05). Compared with scores in the traditional therapy group, SGRQ scores in the rehabilitation therapy group were also apparently reduced after treatment (P<0.05). Results suggest that rehabilitation training can significantly improve the quality of life of COPD patients (**Figure 8**).

Rehabilitation training raised BMI and inhibited inflammatory factor expression

BMIs of patients in the rehabilitation therapy group were significantly increased after treatment, compared with those before treatment

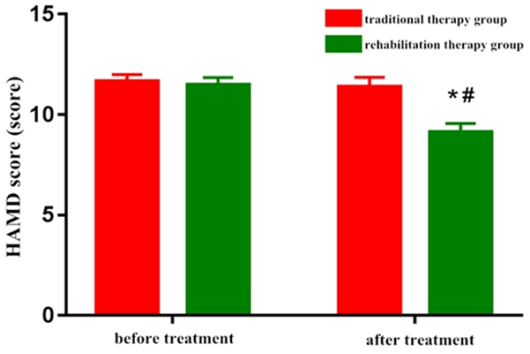

Figure 7. HAMA scores. Note: *P<0.05 vs. before treatment, #P<0.05 vs. traditional therapy group.

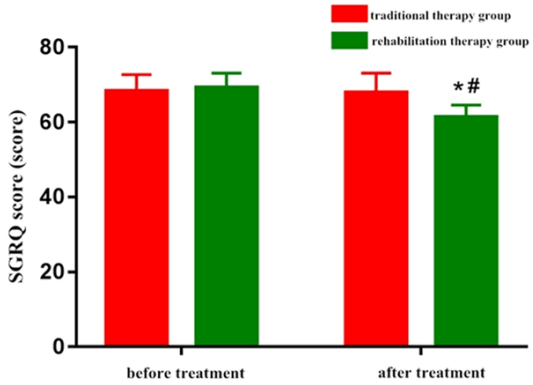

Figure 8. SGRQ scores.

(P<0.05). Compared with levels in the traditional therapy group, BMIs in the rehabilitation therapy group were also statistically increased after treatment (P<0.05). Results suggest that rehabilitation training can remarkably improve myodystrophy in COPD patients (**Table 1**).

IL-1 and IL-6 expression levels of patients in both groups were detected with remarkable decreases after treatment, compared to before treatment. Differences were statistically significant (P<0.05). IL-1 and IL-6 expression levels in the rehabilitation therapy group were statistically inhibited after treatment, compared with those in the traditional therapy group (P<0.05), suggesting that rehabilitation training further suppressed inflammation in COPD patients based on traditional therapy (**Table 1**).

Correlation between motor function and myodystrophy

There was a positive correlation between 6MWD and BMI (r=0.299), indicating that motor function is associated with myodystrophy of COPD patients (**Figure 9**).

Discussion

Airway structural remodeling and obstructive emphysema induced by COPD can seriously affect patient lung function, leading to limited activity of daily living and loss of labor ability [3]. Studies have confirmed [4, 5] that the lung function limitation of COPD patients cannot be overcome via drug therapy. Lung injuries of COPD patients still progressively exacerbate. In this study, it was found that traditional drug therapy could indeed improve 6MWD, BODE, and Borg scores of patients with COPD in the stable phase. Results suggest its efficacy in ameliorating motor ability, to a certain extent. This also improves conditions and enhances perceived exertion of patients in the treatment of COPD in the stable phase. However, drug therapy fails to recover patient lung function and activity levels of daily living and quality of life. Present results are consistent with previous research, indicating that the curative effects of simple drug therapy on COPD in the stable phase are limited. Therefore, the roles of rehabilitation training in improving the lung function of patients with COPD in the stable phase have been increasingly studied. It has been proposed that rehabilitation training, including training during hospitalization and at home after discharge, is essential for COPD patients. It is extremely important in improving lung function of patients with COPD in the stable phase [6, 7]. At the same time, many inflammatory factors produced in COPD, a systemic inflammatory disease, can lead to respiratory muscular atrophy [8]. Moreover, excessive lung ventilation induced by COPD can further result in abnormalities in the diaphragm and thorax, ultimately affecting patient respiratory function [9, 10]. It is believed currently that the degree of respiratory muscle dysfunction has a high correlation with the condition of COPD patients [11, 12]. Rehabilitation training is effective for COPD patients. It can improve strength and endurance of respiratory muscles, reducing dyspnea and improving motor ability, as well as quality of life levels, of patients [13-15]. In the current study, for treatment of COPD in the stable phase, rehabilitation training effectively ameliorated dyspnea symptoms, improved lung function, and increased motor abilities of patients. At the same time, rehabilitation training

Table 1. BMI and inflammatory factor expression ($\bar{x} \pm s$)

Group	Before treatment			After treatment		
	BMI (kg/m^2)	IL-1 (pg/mL)	IL-6 (pg/mL)	BMI (kg/m^2)	IL-1 (pg/mL)	IL-6 (pg/mL)
Traditional therapy group	18.72±0.55	68.35±6.67	88.43±3.43	17.58±0.72	42.83±4.32*	63.73±6.55*
Rehabilitation therapy group	17.59±0.73	72.35±3.22	86.38±5.12	26.41±0.44*,#	33.13±3.77*,#	48.82±4.33*,#

Note: *P<0.05 vs. before treatment, #P<0.05 vs. traditional therapy group.

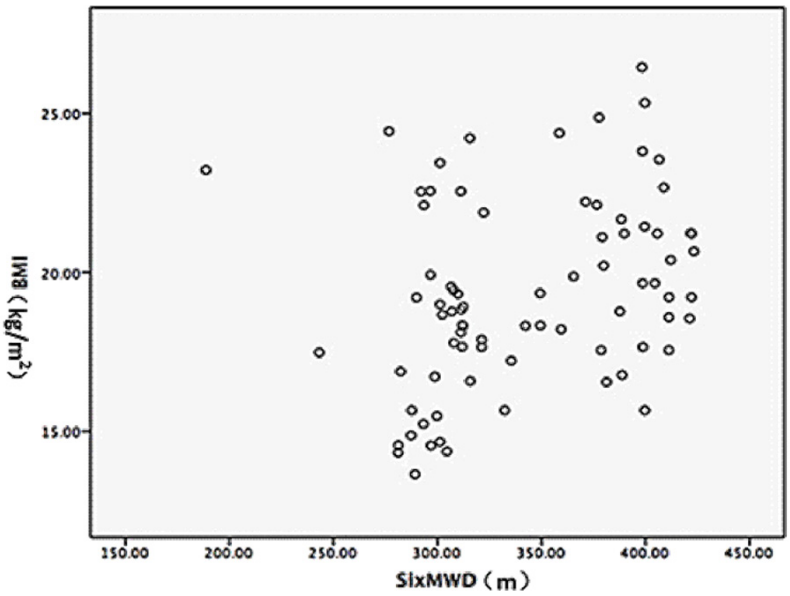

Figure 9. Correlation between 6MWD and BMI.

effectively improved depression and anxiety levels, increased perceived exertion, and improved the quality of life of patients. In rehabilitation training, respiratory muscles of patients with COPD in the stable phase are exercised. The abilities of the respiratory muscles are enhanced. Normal physiological functioning of the thorax is maintained. This may be the major reason for improvements in the respiratory function of COPD patients [16-18]. Moreover, motor function of COPD patients will be further boosted due to the improvement of lung function. This is also helpful in regulating patient depression, anxiety, and concern about the disease. It enhance confidences and increases the quality of life of patients [19, 20]. According to correlation analyses in this study, it was proposed that rehabilitation training may improve myodystrophy through improving the motor function of COPD patients. Results, however, require further investigation.

Conclusion

In conclusion, rehabilitation training plays a facilitating role in the treatment of COPD in the stable phase. Rehabilitation training improves lung function and motor function levels of COPD patients, increasing quality of life. Thus, rehabilitation training has potential value in clinical practice.

Disclosure of conflict of interest

None.

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