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Effect of Ambroxol Hydrochloride Combined with Pulmonary Rehabilitation on Elderly Patients with COPD and Pulmonary Infection

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Abstract:

Objective: To analyze the effect of ambroxol hydrochloride combined with pulmonary rehabilitation in elderly patients with chronic obstructive pulmonary disease (COPD) and pulmonary infection. *Methods:* A total of 80 elderly patients with COPD combined with pulmonary infection, admitted between January 2022 and December 2023, were randomly divided into an observation group and a control group. The observation group received ambroxol hydrochloride combined with pulmonary rehabilitation, while the control group was treated with ambroxol hydrochloride alone. The efficacy of the two treatments was evaluated. *Results:* The observation group exhibited a shorter clinical symptom resolution time ($P < 0.05$). Following treatment, the observation group demonstrated higher oxygen saturation levels and lower levels of inflammatory factors, including interleukin-6 ($P < 0.05$). Additionally, the lung function index in the observation group improved significantly ($P < 0.05$). *Conclusion:* For elderly patients with COPD and pulmonary infection, pulmonary rehabilitation training effectively enhances the resolution rate of clinical symptoms, reduces inflammatory factor levels, improves oxygen saturation, and facilitates pulmonary function recovery.

Keywords:

Ambroxol hydrochloride
Pulmonary rehabilitation
Elderly COPD
Pulmonary infection

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1. Introduction

In recent years, the prevalence of chronic obstructive pulmonary disease (COPD) in China has been steadily increasing, with middle-aged and elderly populations constituting the primary affected groups. COPD patients often experience symptoms such as persistent cough and dyspnea, which significantly impact their daily lives. Despite advancements in medical treatments, there remains no specific cure for COPD, and the disease is often complicated by conditions such as pulmonary infections. The treatment of COPD in clinical practice typically involves bronchodilator medications, oxygen therapy, and anti-infection measures to alleviate symptoms, although the outcomes are often limited.

Elderly patients, due to age-related declines in organ function and weakened immune responses, face an elevated

risk of infection, necessitating more comprehensive and tailored treatment strategies. Ambroxol hydrochloride, a mucolytic agent, activates airway ciliary function, reduces mucus viscosity, enhances pulmonary surfactant synthesis, and alleviates respiratory symptoms [1,2]. Pulmonary rehabilitation, on the other hand, involves customized training programs designed to strengthen respiratory muscles, improve exercise tolerance, and reduce dyspnea.

This study focuses on the combined application of ambroxol hydrochloride and pulmonary rehabilitation to address the treatment challenges in elderly patients with COPD complicated by pulmonary infection, aiming to optimize therapeutic strategies and improve clinical outcomes.

2. Materials and methods

2.1. General information

The subjects in this study were patients diagnosed with COPD, aged over 60 years, with 80 cases complicated by pulmonary infection. The patients were randomly divided into an observation group and a control group. In the observation group, there were 23 males and 17 females, aged between 60 and 75 years, with a mean age of 69.53 ± 3.47 years. In the control group, there were 24 males and 16 females, aged between 61 and 76 years, with a mean age of 69.63 ± 3.51 years. A comparative analysis of the two groups revealed no significant differences ($P > 0.05$).

Inclusion criteria: (1) Patients meeting the diagnostic criteria for COPD; (2) Patients aged over 60 years with a confirmed pulmonary infection.

Exclusion criteria: (1) Patients with known allergies to ambroxol hydrochloride; (2) Patients with comorbid tuberculosis.

2.2. Methods

All patients received conventional treatment based on symptomatic management, including measures such as spasmolysis, oxygen therapy, and anti-infection treatment to alleviate clinical symptoms.

2.2.1. Treatment methods in the control group

Patients in the control group received ambroxol hydrochloride treatment. The drug, manufactured by Shantou Jinshi Pharmaceutical Factory Co., LTD. (National Medicine Approval Number: H20083547), was administered via intravenous infusion. The medication was prepared by mixing the drug solution with sodium chloride solution in a 30 mg:100 mL ratio and was administered twice daily.

2.2.2. Treatment methods in the observation group

In addition to the treatment provided to the control group, the observation group underwent pulmonary rehabilitation.

(1) Promotion and education on rehabilitation training: Medical staff analyzed the patients' physical examination results to assess their physiological condition, confirm disease severity, and determine the key points of rehabilitation training. Educational content was optimized to deepen patients' understanding of disease-related knowledge and enhance their cooperation [3]. Efforts were made to develop a multi-channel health education system, integrating new media (e.g., WeChat) with traditional media. The use of visual aids improved comprehension and promoted self-care. Psychological support was also provided to address any negative emotions, ensuring patient compliance with pulmonary rehabilitation training. Regular thematic lectures allowed patients to demonstrate their rehabilitation training, enabling timely correction of mistakes and improving training enthusiasm.

(2) Enhancement of pulmonary rehabilitation training programs: Patients were guided through diaphragmatic breathing exercises. This involved positioning one hand on the chest and the other on the abdomen, maintaining an immobile upper body while exhaling and compressing the abdomen, and allowing abdominal expansion during inhalation. Inhalation was performed through the nose, and exhalation through pursed lips. Lip-pursed breathing exercises were also introduced, with nasal inhalation followed by slow, controlled exhalation through pursed lips, akin to whistling. Each training session lasted approximately 20 minutes [4]. Upper limb and thoracic exercises were implemented, including upward stretches, arm extensions, and movements to enhance thoracic expansion. Patients performed coordinated movements such as bending

the elbows, spreading the arms, bending the knees, and raising the back of the feet. Training plans were adjusted according to patient progress to ensure appropriate intensity and frequency, promoting optimal recovery of pulmonary function [5].

2.3. Observation indicators

The clinical symptoms, such as cough, were analyzed in both groups. Oxygen saturation and levels of inflammatory factors, including interleukin-6, were measured using an automatic biochemical analyzer. Pulmonary function indices, such as forced vital capacity (FVC), forced expiratory volume in the first second (FEV1), and the FVC/FEV1 ratio, were assessed using a pulmonary function detector.

2.4. Statistical analysis

Data were processed using SPSS 23.0. The χ^2 test was applied to count data, while the *t*-test was used for measurement data. A *P*-value < 0.05 indicated a statistically significant difference.

3. Results

3.1. Clinical symptoms

As shown in **Table 1**, the resolution time for clinical symptoms in the observation group was significantly shorter compared to the control group, with $P < 0.05$.

3.2. Oxygen saturation and inflammatory factors

Following treatment, the observation group demonstrated higher oxygen saturation and significantly lower levels of inflammatory factors, including interleukin-6, compared to the control group ($P < 0.05$), as shown in **Table 2**.

3.3. Pulmonary function

As shown in **Table 3**, the pulmonary function indices, including FVC, FEV1, and the FVC/FEV1 ratio, showed

Table 1. Time to resolution of clinical symptoms in the two groups (mean ± SD, days)

Group	*n*	Pulmonary moist rales	Cough	Expectoration	Shortness of breath	Fever
Observation group	40	4.53 ± 0.39	4.15 ± 0.43	5.32 ± 1.01	5.68 ± 0.42	1.56 ± 0.21
Control group	40	6.58 ± 0.24	6.02 ± 0.52	8.16 ± 1.37	7.91 ± 0.29	2.86 ± 0.37
t	-	10.352	11.415	12.312	9.839	10.237
P	-	0.001	0.001	0.001	0.001	0.001

Table 2. Oxygen saturation and inflammatory factor levels before and after treatment in both groups (mean ± SD)

Group	*n*	Blood oxygen saturation (%)		Interleukin-6 (ng/mL)		Interleukin-8 (ng/mL)	
		Before	After	Before	After	Before	After
Observation group	40	82.34 ± 6.86	94.02 ± 2.47	3.35 ± 0.34	1.89 ± 0.31	6.02 ± 1.15	2.27 ± 0.84
Control group	40	82.41 ± 6.71	85.64 ± 2.54	3.41 ± 0.28	2.57 ± 0.34	6.08 ± 1.11	3.45 ± 0.34
t	-	0.739	9.584	1.126	10.851	0.183	10.352
P	-	0.464	0.001	0.264	0.001	0.854	0.001

Table 3. Pulmonary function indices before and after treatment in both groups (mean ± SD)

Group	*n*	FVC (L)		FEV1 (L)		FVC/FEV1 (%)	
		Before	After	Before	After	Before	After
Observation group	40	1.47 ± 0.38	2.56 ± 0.43	0.95 ± 0.21	1.69 ± 0.24	51.43 ± 3.47	62.24 ± 3.48
Control group	40	1.49 ± 0.35	1.86 ± 0.45	0.94 ± 0.18	1.21 ± 0.23	51.39 ± 3.52	53.26 ± 2.65
t	-	0.318	8.957	0.412	8.124	0.328	9.524
P	-	0.778	0.003	0.821	0.011	0.739	0.001

significant improvement in the observation group after treatment ($P < 0.05$).

4. Discussion

In general, the physiological characteristics of elderly individuals, coupled with reduced immunity and impaired defense mechanisms, increase the risk of developing COPD and predispose these patients to pulmonary infections. In severe cases, the condition may progress to pulmonary heart disease and eventually cause respiratory failure, posing significant risks to the patients' lives [6,7]. Standard treatment for this condition typically includes oxygen therapy, bronchodilators, and anti-infection measures to alleviate symptoms. However, the efficacy of such treatments is often suboptimal. Studies have reported that symptomatic treatment in elderly patients with COPD and pulmonary infection achieves an effectiveness rate of approximately 70%, which is attributed to the reduced immunity of elderly patients that delays recovery [8]. Additionally, prolonged use of antibiotics may impair infection resistance, increase bacterial resistance, and complicate treatment.

Pulmonary rehabilitation has been shown to improve lung function in such patients. However, certain studies suggest that conventional rehabilitation methods may fall short of achieving optimal outcomes, limiting their effectiveness in improving lung function [9]. Respiratory rehabilitation training has been reported to enhance tidal volume, slow expiratory rates, stabilize airway pressure, and improve exercise tolerance in patients [10]. Nonetheless, the accumulation of sputum can exacerbate disease control challenges, emphasizing the importance of effective drainage to alleviate infection symptoms.

The application of ambroxol hydrochloride stimulates the bronchial mucous glands, increasing neutral mucopolysaccharide secretion, reducing acidic mucopolysaccharide levels, and enhancing metabolic activity. These effects facilitate respiratory mucus clearance. Research indicates that ambroxol hydrochloride has a relatively long half-life of approximately seven hours, is primarily metabolized by the liver, and avoids significant drug accumulation, reducing the risk of adverse effects [11].

The findings of this study revealed that clinical symptoms resolved more quickly in the observation group. This outcome may be attributed to the combined use of ambroxol hydrochloride and pulmonary rehabilitation training. While ambroxol hydrochloride effectively alleviates lung infection to some extent, its standalone therapeutic effect is limited. When complemented by pulmonary rehabilitation, incorporating respiratory and physical training ensures correct breathing techniques, enhances respiratory tidal volume, facilitates sputum clearance, and expedites symptom resolution.

This study also demonstrated higher oxygen saturation levels and lower inflammatory factor levels in the observation group after treatment. The increased oxygen saturation may result from the stimulation of alveolar function by ambroxol hydrochloride, which enhances the production of active substances, prevents alveolar atrophy, reduces alveolar collapse, improves lung compliance, and alleviates airway hyperresponsiveness and inflammation. Concurrently, pulmonary rehabilitation training improves immune function through respiratory and limb exercises, enhances muscle oxygen-carrying capacity, and further reduces inflammatory factor levels [12,13].

Moreover, significant improvements in lung function were observed in the observation group. This result can likely be attributed to the integration of pulmonary rehabilitation training tailored to the patient's conditions. By addressing psychological needs, adjusting health education pathways, and increasing awareness of rehabilitation techniques and key measures, patients were guided to adopt correct breathing techniques, enhancing airway compliance, lung ventilation, and overall pulmonary function recovery [14,15].

5. Conclusion

In conclusion, the treatment of elderly patients with COPD and pulmonary infection through a combination of ambroxol hydrochloride and pulmonary rehabilitation effectively improves pulmonary function, alleviates clinical symptoms, and reduces inflammatory responses.

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Disclosure statement

The author declares no conflict of interest.

References

[1] Jia M, Wu T, Xu H, et al., 2024, The Influence of Pulmonary Rehabilitation Nursing Under the Mode of Personalized Physical and Mental Demands Nursing on Symptom Improvement and Lung Function in Elderly Patients with COPD. Heilongjiang Medical Science, 47(6): 185–186 + 189.

[2] Wu P, 2024, Analysis of the Impact of Pulmonary Rehabilitation Nursing Intervention on Lung Function and Quality of Life in Patients with Stable COPD. Modern Diagnosis and Treatment, 35(16): 2515–2517.

[3] Wu Y, 2024, Impact of Self-Management of COPD Rehabilitation Care on Lung Function and Quality of Life. Heilongjiang Traditional Chinese Medicine, 53(3): 170–172.

[4] Wang X, Wang H, 2024, Analysis of the Efficacy of Oxygen Therapy Combined with Pulmonary Rehabilitation Functional Exercise in Patients with COPD. Gansu Medicine, 43(2): 151–152 + 156.

[5] Qin Y, Li M, Yu H, et al., 2023, Effect of Pulmonary Rehabilitation Training Combined with Personalized Systematic Care Intervention on Treatment Compliance and ESCA Score in Elderly COPD Patients. Heilongjiang Medical Science, 46(5): 111–113.

[6] Wang J, 2022, Clinical Outcome of Treatment with Ambroxol Hydrochloride in Elderly COPD Patients with Pulmonary Infection. Medical Theory and Practice, 35(19): 3288–3290.

[7] Yang S, 2021, Study on the Efficacy and Adverse Drug Reactions of Ambroxol Hydrochloride in the Treatment of Senile COPD Associated with Pulmonary Infection. Systematic Medicine, 6(15): 59–61.

[8] Liu B, 2021, Clinical Value Analysis of Ambroxol Hydrochloride in COPD Combined with Pulmonary Infection. Community Physicians in China, 37(21): 30–31.

[9] Gao S, 2021, Clinical Effect of Ambroxol Hydrochloride in the Treatment of Senile COPD Combined with Pulmonary Infection. Medical Information, 34(11): 158–160.

[10] Deng Y, 2021, Effect of Ambroxol Hydrochloride in the Treatment of Elderly Chronic Obstructive Pulmonary Disease Combined with Pulmonary Infection. Jilin Medical, 42(5): 1141–1143.

[11] Chen D, 2021, Observation of the Effect of Ambroxol Hydrochloride Treatment in Elderly Patients with COPD with Pulmonary Infection. Modern Drug Application in China, 15(9): 160–162.

[12] Guo Z, 2020, Efficacy and Adverse Effects of Ambroxol Hydrochloride in the Treatment of Senile COPD Combined with Pulmonary Infection. Rural Health in China, 12(19): 77 + 79.

[13] Fan Z, Xu Z, 2020, Effect of Ambroxol Hydrochloride in the Treatment of Elderly Chronic Obstructive Pulmonary Disease Combined with Pulmonary Infection. Continuing Medical Education in China, 12(25): 148–151.

[14] Cao Q, Liu J, Xu Z, et al., 2020, Analysis of the Clinical Effect of Ambroxol Hydrochloride in Senile COPD Combined with Pulmonary Infection. Heilongjiang Medical Science, 43(4): 94–95.

[15] Li L, 2020, Analysis of the Effects and Adverse Effects of Ambroxol Hydrochloride Combination in COPD with Pulmonary Infection. China, 11(15): 67–69.