Allergologia et immunopathologia
Sociedad Española de Inmunología Clínica, Alergología y Asma Pediátrica
www.all-imm.com

ORIGINAL ARTICLE

OPEN ACCESS

Efficacy of Xuanbai Chengqi decoction combined with western medicine in treating AECOPD with phlegm-heat obstructing lung syndrome: a clinical study

Quan He[a#], Guangfei Wei[b#], Xuzhi Lu[a#], Weiqi Feng[a], Meiyue Yu[c], Xiaomei Ma[a*]

[a]*Department of Respiratory and Critical Care Medicine, Zhenjiang Hospital of Chinese Traditional and Western Medicine, Affiliated Zhenjiang Integrated Hospital of Traditional Chinese and Western Medicine of Xinglin College, Nantong University, Zhenjiang, Jiangsu, China*
[b]*Clinical Research Center (CRC), Zhenjiang Hospital of Chinese Traditional and Western Medicine, Affiliated Zhenjiang Integrated Hospital of Traditional Chinese and Western Medicine of Xinglin College, Nantong University, Zhenjiang, Jiangsu, China*
[c]*Department of Acupuncture, Zhenjiang Hospital of Traditional Chinese Medicine, Zhenjiang, Jiangsu, China*

[#]These authors contributed equally to the work.

Received 25 June 2024; Accepted 14 September 2024
Available online 1 March 2025

KEYWORDS
AECOPD;
clinical efficacy;
phlegm-heat obstructing lung syndrome;
Xuanbai Chengqi decoction

Abstract
Objective: To explore the efficacy of Xuanbai Chengqi Decoction combined with conventional Western medicine in the treatment of AECOPD patients with phlegm-heat obstructing the lung syndrome.
Methods: A retrospective analysis was conducted on the clinical data of 166 patients with this syndrome admitted to our hospital between December 2023 and March 2024. Patients were divided into a study group (Xuanbai Chengqi Decoction + conventional Western medicine treatment, 83 cases) and a control group (conventional Western medicine treatment, 83 cases). The clinical efficacy, Traditional Chinese Medicine (TCM) syndrome scores, blood routine indicators, inflammatory factors, and other clinical outcomes were compared between the two groups.
Results: Before treatment, there were no significant differences in the above-mentioned indicators between the two groups ($P > 0.05$). After treatment, the study group showed a significantly higher overall effective treatment rate, lymphocyte percentage, SOD, and NO levels, and a significantly lower TCM syndrome score, neutrophil percentage, white blood cell count, TNF-α, IL-6, CRP, and MOD levels, with statistical significance ($P < 0.05$).
Conclusion: Xuanbai Chengqi Decoction combined with Western medicine treatment can effectively alleviate the clinical symptoms of AECOPD patients with phlegm-heat obstructing the lungs syndrome, improve blood routine indicators, control inflammation, and enhance the overall therapeutic effect.

***Corresponding author**: Xiaomei Ma, Department of Respiratory and Critical Care Medicine, Zhenjiang Hospital of Chinese Traditional and Western Medicine, Affiliated Zhenjiang Integrated Hospital of Traditional Chinese and Western Medicine of Xinglin College, Nantong University, No. 18 Tuanshan Road, Runzhou District, Zhenjiang, Jiangsu, China. *Email address*: lf_zhou0117@163.com

https://doi.org/10.15586/aei.v53i2.1180

Introduction

Acute exacerbation of chronic obstructive pulmonary disease (AECOPD) is characterized by acute manifestations, such as intense coughing, variable sputum production, significantly worsened dyspnea, and fever.[1] AECOPD is triggered by various factors, such as respiratory tract infections (both viral and bacterial), air pollution, allergies, and inappropriate discontinuation of long-term inhaled medications. Without timely and effective emergency management, frequent exacerbations lead to accelerated lung function decline, which may result in shock, respiratory failure, organ dysfunction, and increased mortality.[2]

Currently, the standard clinical treatment for AECOPD involves a combination of oxygen therapy, bronchodilators (e.g., theophylline), antibiotics (e.g., amoxicillin-clavulanate), and mucolytics (e.g., acetylcysteine),[3] which aims to dilate the airways, correct hypoxemia, and facilitate sputum clearance, thereby providing short-term relief to patients.[4] However, the use of these medications can frequently cause gastrointestinal tract irritation.[5] palpitations, and, in more acute cases, drug resistance. Furthermore, the intense inflammatory response associated with AECOPD often limits the effectiveness of conventional western medical therapies.[5]

In traditional Chinese medicine (TCM), AECOPD is commonly characterized by a primary syndrome of "phlegm-heat obstructing the lungs."[6] This syndrome typically arises from the external invasion of warm pathogens, which then generate internal heat. This internal heat consumes body fluids, leading to their coagulation into phlegm, which subsequently congeals and obstructs the lungs.[7] Recently, the implementation of TCM has increasingly contributed to the management of the phlegm-heat obstructing the lungs syndrome in AECOPD. Among the various TCM interventions, Xuanbai Chengqi decoction has emerged as a remedy with distinctive therapeutic effects for this condition.[8] The primary functions of Xuanbai Chengqi decoction include clearing the lungs, relieving asthma, purging heat, and promoting bowel movements. Its medicinal composition effectively addresses the issues such as impaired lung *qi* (energy) and obstructed bowel *qi*, associated with phlegm-heat obstructing the lungs. Therefore, Xuanbai Chengqi decoction improves clinical manifestations, such as breathing difficulties, cough, and production of sputum in AECOPD patients.

In the current study, we investigated the clinical effects of combining Xuanbai Chengqi decoction with conventional western medicine for treating AECOPD with phlegm-heat obstructing the lungs.

Materials and Methods

General information

We conducted a retrospective analysis of clinical data of 166 patients with AECOPD presenting with phlegm-heat obstructing the lungs, who were admitted to our hospital between December 2023 and March 2024. The patients were categorized into a study group (n = 83) and a control group (n = 83) based on their treatment methods. Preliminary analyses showed no significant differences in the general characteristics between the two groups (P > 0.05), indicating compatibility between the groups (Table 1).

Diagnostic criteria

1. Western medicine diagnostic criteria: We followed the criteria established by the Global Initiative for Chronic Obstructive Lung Disease (GOLD 2021),[9] and the Chronic Obstructive Pulmonary Disease Diagnosis and Treatment Guidelines (2021).[10]
2. Traditional Chinese Medicine Diagnosis Criteria: According to the diagnostic criteria for the phlegm-heat obstructing the lungs syndrome outlined in *Traditional Chinese Internal Medicine* edited by Tian Delu and others.[11]

Inclusion and exclusion criteria

Inclusion Criteria

1. Patients that met the diagnostic criteria for AECOPD phlegm-heat obstructing the lung syndrome and exhibited typical manifestations, such as cough, fever, dyspnea, and sputum production.
2. No participation in any other clinical trial in the month preceding inclusion.
3. Age between 40 and 80 years.
4. Discontinued the use of other bronchodilators at least 2 days before enrollment.

Table 1 Comparison of general information between the two groups ($\bar{x} \pm s$).

Group	Number of patients	Gender		Age (yr)	BMI (kg/m^2)	COPD course (yr)	6-min walk average distance (m)
		Males	Females				
Study group	83	43	40	71.83 ± 7.60	22.72 ± 2.43	10.45 ± 1.23	213.77 ± 23.17
Control group	83	42	41	72.13 ± 7.15	22.91 ± 2.34	10.62 ± 1.17	215.18 ± 22.34
X^2/T value	-	0.024		0.262	0.513	0.912	0.399
P-value	-	0.877		0.397	0.305	0.183	0.346

χ^2 (chi-square) test to observe whether the data follows a normal distribution, s ($\bar{x} \pm s$), standard error of the mean), t (t-distribution) is used to determine if there is a significant difference between the means of two groups of data.

5. Possessed good communication skills and clear consciousness.
6. Voluntarily participated and signed an informed consent form.

Exclusion Criteria

1. Patients with liver or kidney functions impairment.
2. Individuals with concurrent pulmonary diseases, such as tuberculosis or tumors.
3. Patients with mental disorders.
4. Patients with a history of drug allergies or those deemed unsuitable for TCM decoction treatment.
5. Pregnant women.
6. Poor compliance during the treatment period.
7. Development of complications during the treatment period.
8. Occurrence of allergic reactions or exacerbation of other diseases during the treatment period.
9. Misdiagnosis or loss to follow-up.

Methods

The control group received conventional western medicine treatment, which included the following:

1. Oxygen therapy was initiated immediately upon admission. In addition, a bronchodilator, indacaterol glycopyrronium bromide powder (Novartis Farmaceutica SA, Barcelona, Spain; NMPA approval number: HJ20170390) was given as one capsule daily.
2. Intravenous injections included 4.5 g of piperacillin-tazobactam injection (Huabei Pharmaceutical; NMPA approval number: H20064402), diluted, every 8 h in 100 mL of normal saline, and 0.25 g of aminophylline injection (Shandong Xinhua Pharmaceutical, Shandong, China; NMPA approval number: H37020660), diluted, every 12 h in 100 mL of normal saline.
3. In addition, injection 4000 IU enoxaparin sodium, subcutaneous (Hangzhou Jiuyuan Gene Engineering, Zhejiang Province, China; NMPA approval number: H20064067) was administered along with tablet acetylcysteine (Hainan Zanbon Pharmaceutical, Shangai, China; NMPA approval number: H20080326), one tablet taken orally TDS.

The study group received the same treatment as the control group, with the addition of Xuanbai Chengqi decoction, administered orally twice daily, after breakfast and dinner. Both groups were treated for 2 weeks.

Observation indices

1. The observation indices for evaluating the effectiveness of both treatments included different parameters. First, the Chinese Medicine Syndrome Score was used, following the scoring criteria detailed in the section of Lung Diseases from *Internal Medicine of Traditional Chinese Medicine*. This scoring system assessed the following four main manifestations:
   - *Cough*: The score ranged from 0 to 6 points. A score of 0 point indicated no cough. A score of 2 points was given for occasional coughing that did not affect quality of daily life. Frequent coughing that moderately affected quality of daily life received 4 points. Acute coughing that significantly affected quality of daily life was assigned 6 points.
   - *Sputum volume*: The scoring for sputum volume ranged from 0 to 6 points. A score of 0 point represented no sputum. Small amount of sputum that was easily expectorated was allocated 2 points. A moderate amount of sputum that was difficult to expectorate was assigned 4 points. A large amount of thick sputum that was hard to expectorate was given 6 points.
   - *Fever*: The scoring for fever ranged from 0 to 6 points. No fever was allotted 0 point. A low-grade fever between 37.3°C and 38°C was allotted 2 points. Moderate fever ranging from 38.1°C to 39°C was assigned 4 points. A high fever above 39.1°C was assigned 6 points.
   - *Dyspnea*: Dyspnea was scored from 0 to 6 points. No significant dyspnea was assigned 0 point. Slight dyspnea after activity that was relieved by rest received 2 points. Slight dyspnea with minimal activity and slow relief after rest was allotted 4 points. Dyspnea at rest was assigned 6 points.
2. Routine blood indicators were assessed by comparing changes in lymphocyte percentage, neutrophil percentage, and white blood cell (WBC) count between both groups.
3. Inflammatory factor indicators: Fasting venous blood samples were collected from both groups before and after treatment, and the levels of tumor necrosis factor-alpha (TNF-α), interleukin-6 (IL-6), and C-reactive protein (CRP) were measured and compared using the ELISA method.
4. Oxidative stress indicators: Fasting venous blood (4 mL) was drawn from both groups before and after treatment, centrifuged at 3500 rpm for 10 minutes, and serum was separated. The levels of superoxide dismutase (SOD) and malondialdehyde (MDA) were measured using an automated biochemical analyzer, and nitric oxide (NO) levels were measured using the nitrate reductase method.
5. Clinical efficacy: Clinical efficacy was evaluated based on the Guidelines for the Diagnosis and Treatment of Chronic Obstructive Pulmonary Disease (2021) and Traditional Chinese Medicine Internal Medicine. The criteria for evaluation were as follows:
   - *Cured*: A reduction of ≥95% in Traditional Chinese Medicine (TCM) syndrome score, complete resolution of symptoms and signs, normal lung auscultation, and significant recovery of laboratory test indicators.
   - *Significantly effective*: A reduction of 70-94% in TCM syndrome score, significant relief of symptoms, marked reduction in cough and sputum, notable improvement in wheezing, improvement in lung auscultation, and substantial improvement in examination indicators.
   - *Effective*: A reduction of 30-69% in TCM syndrome score, moderate relief of symptoms, some improvement in cough, sputum, and wheezing, partial improvement in lung auscultation, and some changes

in examination indicators but not meeting the criteria for significantly effective.
- *Ineffective*: A reduction of <30% in TCM syndrome score, no significant improvement in symptoms, lung auscultation, or examination indicators, or even worsening. The total effective rate = (1 - ineffective cases/total cases) × 100%.

Statistical analysis

Statistical analysis was performed using SPSS 20.0. For normally distributed continuous data, the mean ± standard deviation (±S) was used to represent the data. One-way analysis of variance (ANOVA) was used for comparisons of multiple groups with normal distribution. For comparisons between multiple non-normally distributed groups or between normal and non-normal distribution groups, the rank sum test was used. Chi-square test or non-parametric tests were used for comparisons of categorical data. A p-value of <0.05 was considered statistically significant.

Results

Comparison of Chinese Medicine Syndrome Scores between the two groups

Prior to treatment, our results showed no significant differences in scores for cough, sputum volume, fever, and dyspnea between the study and control groups (P > 0.05). However, after treatment, the study group exhibited significantly lower scores for all four indicators. Specifically, the scores for cough, sputum volume, fever, and dyspnea were notably reduced in the study group, compared to the control group (P < 0.05) (Table 2).

Comparison of Routine Blood Indicators between the two groups

Prior to treatment, no significant differences were observed in the lymphocyte percentage, neutrophil percentage, or WBC count between the study and control groups (P > 0.05). However, after treatment, the study group showed significant improvements in these indicators. Specifically, the study group had a higher lymphocyte percentage and lower neutrophil percentage and WBC count, compared to the control group, with all differences being statistically significant (P < 0.05) (Table 3).

Comparison of Inflammatory Factor Indexes between the two groups

Prior to treatment, no significant differences were observed in the levels of TNF-α, IL-6, and CRP between the study and control groups (P > 0.05). After treatment, the study group demonstrated significantly lower levels of TNF-α, IL-6, and CRP, compared to the control group (P < 0.05) (Table 4).

Comparison of Oxidative Stress Indicators between the two groups

Prior to treatment, no significant differences were observed in the levels of SOD, MDA, and NO between the study and control groups (P > 0.05). Following the treatment, the study group specifically exhibited significant changes in oxidative stress indicators. It had lower levels of MDA and higher levels of SOD and NO, compared to the control group, with all differences being statistically significant (P < 0.05) (Table 5).

Table 2 Comparison of traditional Chinese medicine (TCM) syndrome scores between the two groups ($\bar{x}$ ± s score).

Indicators		Study group (n = 83)	Control group (n = 83)	*t*-value	P-value
Cough	Before treatment	4.37 ± 0.56	4.41 ± 0.54	−0.424	0.672
	After treatment	2.12 ± 0.50	3.42 ± 0.52	−16.363	<0.001
	t-value	28.121	12.431		
	P-value	<0.001	<0.001		
Amount of phlegm	Before treatment	3.86 ± 0.54	3.90 ± 0.53	−0.577	0.565
	After treatment	1.92 ± 0.52	2.71 ± 0.55	−9.521	<0.001
	t-value	25.724	13.790		
	P-value	<0.001	<0.001		
Fever	Before treatment	4.11 ± 0.54	4.13 ± 0.51	−0.294	0.769
	After treatment	2.14 ± 0.50	3.35 ± 0.50	−15.498	<0.001
	t-value	25.979	9.729		
	P-value	<0.001	<0.001		
Difficulty in breathing	Before treatment	5.04 ± 0.53	5.08 ± 0.52	−0.591	0.556
	After treatment	2.67 ± 0.50	3.59 ± 0.54	−11.351	<0.001
	t-value	31.133	19.308		
	P-value	<0.001	<0.001		

Table 3 Comparison of routine blood indicators between the two groups ($\bar{x}$ ± s score).

Indicators		Study group (n = 83)	Control group (n = 83)	*t*-value	P-value
Lymphocyte (%)	Before treatment	21.37 ± 2.58	21.46 ± 2.24	−0.240	0.810
	After treatment	29.24 ± 2.93	25.75 ± 2.61	8.102	<0.001
	t-value	-19.077	-10.864		
	P-value	<0.001	<0.001		
Neutrophil (%)	Before treatment	69.17±7.05	69.84±6.83	−0.613	0.541
	After treatment	51.39 ± 5.21	60.08 ± 6.12	−9.859	<0.001
	t-value	18.472	10.003		
	P-value	<0.001	<0.001		
White blood cell count ($\times10^9$/L)	Before treatment	7.59 ± 0.84	7.63 ± 0.76	−0.322	0.748
	After treatment	5.48 ± 0.57	6.41 ± 0.66	−9.641	<0.001
	t-value	18.365	11.589		
	P-value	<0.001	<0.001		

Table 4 Comparison of inflammatory factor indicators between the two groups ($\bar{x}$ ± s,μg/L).

Indicators		Study group (n = 83)	Control group (n = 83)	*t*-value	P-value
TNF-α (ng/μL)	Before treatment	48.97 ± 4.93	49.14 ± 4.84	−0.211	0.833
	After treatment	30.14 ± 3.43	21.89 ± 2.21	18.390	<0.001
	t-value	28.853	47.877		
	P-value	<0.001	<0.001		
IL-6 (ng/μL)	Before treatment	56.24 ± 5.81	57.21 ± 5.66	−1.101	0.273
	After treatment	23.54 ± 2.42	33.72 ± 3.45	−21.973	<0.001
	t-value	46.446	29.954		
	P-value	<0.001	<0.001		
CRP (mg/L)	Before treatment	110.25 ± 11.81	110.97 ± 10.13	−0.422	0.674
	After treatment	56.74 ± 5.77	67.17 ± 6.81	−10.636	<0.001
	t-value	35.963	31.599		
	P-value	<0.001	<0.001		

Table 5 Comparison of oxidative stress indicators between the two groups ($\bar{x}$ ± s score).

Indicators		Study group (n = 83)	Control group (n = 83)	t-value	P-value
SOD (ng/mL)	Before treatment	172.87 ± 16.31	169.71 ± 17.15	1.216	0.226
	After treatment	235.17 ± 24.04	209.71 ± 20.83	7.292	<0.001
	t-value	−21.170	−12.766		
	P-value	<0.001	<0.001		
MDA (mmol/L)	Before treatment	421.28 ± 39.44	418.73 ± 42.63	0.398	0.691
	After treatment	355.75 ± 36.43	387.17 ± 37.96	−5.441	<0.001
	t-value	11.413	5.034		
	P-value	<0.001	<0.001		
NO (μmol/L)	Before treatment	16.77 ± 1.85	16.96 ± 1.72	−0.650	0.517
	After treatment	33.47 ± 3.45	23.47 ± 2.37	21.710	<0.001
	t-value	−41.754	−20.504		
	P-value	<0.001	<0.001		

Table 6 Comparison of clinical efficacy between the two groups (n, %).

Group	Number of patients	Cured	Markedly effective	Effective	Ineffective	Total effective
Study group	83	31 (37.35)	27 (32.53)	22 (26.51)	3 (3.61)	80 (96.39)
Control group	83	25 (30.12)	23 (27.71)	24 (28.92)	11 (13.25)	72 (86.75)
χ^2 value	-		-			4.992
P-value	-		-			0.025

X^2 (chi-square) test for normal distribution.

Comparison of Clinical Efficacy between the two groups

Following the treatment, the study group demonstrated a significantly higher total effective rate, compared to the control group ($P < 0.05$) (Table 6).

Discussion

As air pollution worsens and various allergens are widely present, the occurrence of AECOPD (acute exacerbation of chronic obstructive pulmonary disease) has become increasingly frequent.[12] This not only severely damages patients' respiratory health, leading to worsened dyspnea, persistent coughing, and sputum production, but also significantly lowers their quality of life. Furthermore, frequent exacerbations cause immense physical and mental distress and psychological stress. In Western medicine, treatment typically involves oxygen therapy to increase blood oxygen saturation, suction devices to reduce airway obstruction and infection, amoxicillin-clavulanate to alleviate lung infections, and the use of theophylline and N-acetylcysteine to improve bronchial function. While Western medical treatments can have good short-term effects, prolonged reliance on Western medications often leads to the development of drug resistance, forcing doctors to frequently change medications or increase doses, which may bring additional side effects and risks, creating new burdens and potential harm to the patient's body.[13]

To seek alternative treatments and improve clinical outcomes, the medical field has turned to traditional Chinese medicine (TCM). TCM, through syndrome differentiation and treatment, considers phlegm-heat obstructing the lungs as a major pattern in AECOPD and uses Xuanbai Chengqi Decoction to clear heat, transform phlegm, and regulate lung qi. The main ingredients of Xuanbai Chengqi Decoction include gypsum, rhubarb, apricot kernel, and trichosanthes peel, which have the effects of clearing lung heat and draining heat from the bowels. It is effective in resolving the phlegm-heat obstructing the lungs, characterized by the pathological condition of phlegm-heat congealing inside the body, lung qi obstruction, and concurrent bowel qi stagnation.[14] When combined with Western treatments, it can enhance antibacterial effects,[15] restore lung qi, correct the pathological state of phlegm-heat obstructing the lungs in AECOPD, and reduce side effects.

In this study, the research group showed significantly lower scores for Traditional Chinese Medicine symptoms such as cough, sputum production, fever, and shortness of breath ($P < 0.05$). This suggests that the combination of Xuanbai Chengqi Decoction and Western medicine treatment can effectively alleviate the typical symptoms of phlegm-heat obstructing the lungs in patients with AECOPD.[16]

In this study, the research group exhibited significantly lower scores for TCM manifestations, including cough, sputum volume, fever, and difficulty in breathing ($P < 0.05$). These findings suggest that the combination of Xuanbai Chengqi decoction with western medicine effectively alleviates the typical manifestations of phlegm and heat obstructing the lungs in AECOPD patients.[17] This combined approach offers a promising strategy to improve clinical outcomes and reduce dependence on conventional western treatments alone.

The advantages of TCM may stem from its comprehensive approach to the overall regulation. Xuanbai Chengqi decoction not only focuses on removing phlegm and clearing heat but also potentially modifies the balance of *qi* and blood as well as the internal organs, thereby alleviating manifestations caused by phlegm and heat obstructing the lungs. This study discovered that combining Xuanbai Chengqi decoction with western medicine significantly improved routine blood indicators in AECOPD patients and phlegm-heat obstruction. The Chinese herbal ingredients work synergistically to provide various therapeutic effects: roasted fritillaries (Liliaceae) moistens the lungs, stops coughing, transforms phlegm, and relieves asthma; raw gypsum clears heat and reduces fire; rhubarb purges heat and promotes bowel movements to expel phlegm and heat; and trichosanthes seeds help to clear the lungs, relieve asthma, promote diuresis, and reduce swelling. Medications rapidly reduce common symptoms in individuals with AECOPD when used in conjunction with levofloxacin for antibacterial and anti-inflammatory effects, theophylline for easing airway spasms, and ambroxol hydrochloride for encouraging sputum discharge.

Patients with AECOPD and phlegm-heat obstruction often exhibit an active inflammatory response and alterations in the immune system, characterized by a relative reduction in lymphocytes and an accumulation of neutrophils to counteract infection and inflammation, which leads to an increased WBC count.[18] The study demonstrated that combining Xuanbai Chengqi decoction with western medicine effectively improved routine blood indicators. Specifically, the percentage of neutrophils and WBC count were significantly lowered ($P < 0.05$) in the study group. The Chinese herbal mixture exerts multi-target effects: roasted fritillaries help to maintain immunological balance by regulating airway pathways; trichosanthes peel improves

the pulmonary milieu and inflammation; and trichosanthes seeds enhance the body's metabolism by boosting *qi* and blood flow. These herbs can have both direct and indirect effects on the immune system,[19] leading to an increase in lymphocytes and a reduction in neutrophils and WBCs.

AECOPD often results in phlegm–heat obstruction in the lungs because of pulmonary infection and the immune system dysfunction, which stimulates macrophages and monocytes and leads to elevated levels of TNF-α and IL-6. In addition, an acute-phase response triggered by the body's stress causes a significant increase in CRP levels to counteract inflammation. This study showed that after treatment, the research group had significantly lower levels of TNF-α, IL-6, and CRP ($P < 0.05$), suggesting that Xuanbai Chengqi decoction combined with western medicine effectively regulated the inflammatory response in AECOPD patients and phlegm and heat obstructing the lungs.[20] The observed anti-inflammatory effects are attributed to the specific actions of herbal components. Raw gypsum increases blood calcium levels, reducing muscle excitability and vascular permeability, thereby exerting a sedative and anti-inflammatory effect. Rhubarb inhibits free radicals, eliminates toxins, and reduces production of inflammation factors. Trichosanthes peel and similar herbs improve local blood supply and microcirculation, promoting the metabolism and clearance of inflammatory substances. Trichosanthes seeds inhibit inflammation-related signaling pathways[20] and suppress the activation of inflammatory factors while enhancing antioxidant activity and improving the inflammatory response. Concurrently, levofloxacin effectively inhibits bacterial-induced inflammation. The combined use of TCM and western medication produces a synergistic effect, leading to effective control of body's inflammatory response.[21]

In AECOPD patients characterized by phlegm and heat obstructing the lungs, a marked increase in oxidative stress is observed. This condition is associated with active lipid peroxidation reactions and elevated production of oxygen free radicals. Inflammatory responses and other stimuli enhance NO synthase activity, resulting in reduced SOD levels and increased MDA and NO levels. The comparison of oxidative stress markers revealed that the research group had significantly lower MDA levels and higher SOD and NO levels ($P < 0.05$). This finding suggests that the combination of Xuanbai Chengqi decoction with western medicine can more effectively improve oxidative stress responses in patients with AECOPD and phlegm–heat obstructing the lungs. The efficacy of Xuanbai Chengqi decoction is attributed to its components, such as rhubarb and trichosanthes seeds, which are known to regulate the antioxidant enzyme system, enhance free radical clearance, and mitigate oxidative damage.[15] In addition, this decoction improves pulmonary ventilation, corrects hypoxemia and hypercapnia,[22] and reduces hypoxia-induced oxidative stress responses. Western medical therapies, including oxygen therapy and anti-infection measures, are crucial for increasing oxygen supply and managing infections. When combined with Xuanbai Chengqi decoction, these therapies effectively diminish oxidative stress damage.

Regarding clinical efficacy, the research group demonstrated a significantly higher overall effective rate ($P < 0.05$). This could be due to Xuanbai Chengqi decoction's ability to counteract drug resistance associated with long-term use of western medications, such as levofloxacin, theophylline, and ambroxol hydrochloride, as well as to to improve the overall condition of the body and regulate organ functions. While Xuanbai Chengqi decoction addresses the underlying pathological aspects of the disease, medications such as levofloxacin provide rapid symptom relief. The integration of both approaches achieves a comprehensive treatment effect.[23]

Based on the above, Xuanbai Chengqi Decoction combined with Western medicine treatment can effectively relieve the clinical symptoms of patients with AECOPD (Acute Exacerbation of Chronic Obstructive Pulmonary Disease) due to phlegm-heat obstructing the lungs, improve blood routine indicators, control inflammatory responses, and enhance clinical efficacy. Additionally, this study has some limitations, including a short follow-up period, limited representativeness of the study population, and an insufficient sample size. These issues will be addressed and improved in future research.

Authors Contributions

Conceptualization, methodology, and writing: original draft was prepared by Quan He. Formal analysis, resources, and investigations were done by Guangfei Wei. Formal analysis, visualization, and data curation were done by Xuzhi Lu. Project administration, supervision, and validation were exercised by Weiqi Feng. Validation, supervision, and writing: review and editing were done by Meiyue Yu and Xiaomei Ma. All authors read and approved the final manuscript.

Conflict of Interest

The authors reported no conflict of interest.

Funding

This work was supported by the Jiangsu Senile Health Research Project (Grant No. LK2021057), Zhenjiang Key Research and Development Project (Grant No. SH2022081), TCM Science and Technology Development Program of Jiangsu Province (Grant No. MS2022125), Zhenjiang Key Research and Development Project (Grant No. SH2023034), and TCM Science and Technology Development Program of Jiangsu Province (Grant No. MS2023141).

Availability of Data and Materials

All data generated or analyzed in this study are included in the published article. The datasets used and/or analyzed in the study are available from the corresponding author on reasonable request.

Ethics approval

Ethical approval was obtained from the Ethics Committee of Zhenjiang Hospital of Chinese Traditional and Western

Medicine, Affiliated Zhenjiang Integrated Hospital of Traditional Chinese and Western Medicine of Xinglin College, Nantong University, China.

Statement of Informed Consent

Written informed consent was obtained from a legally authorized representative(s) for anonymized patient information to be published in this article.

References

1. Liu X et al., Prevalence, risk factor and clinical characteristics of venous thrombus embolism in patients with acute exacerbation of COPD: A prospective multicenter study. Int J Chron Obstruct Pulmon Dis. 2023;18:907–917. https://doi.org/10.2147/COPD.S410954
2. Hoult G, Gillespie D, Wilkinson TMA., Thomas M Francis NA. Biomarkers to guide the use of antibiotics for acute exacerbations of COPD (AECOPD): A systematic review and meta-analysis. BMC Pulmon Med. 2022;22(1):194. https://doi.org/10.1186/s12890-022-01958-4
3. Wu C-T et al. Acute exacerbation of a chronic obstructive pulmonary disease prediction system using wearable device data, machine learning, and deep learning: development and cohort study. JMIR mHealth uHealth. 2021;9(5):e22591. https://doi.org/10.2196/22591
4. Vermeersch K et al. Azithromycin during acute chronic obstructive pulmonary disease exacerbations requiring hospitalization (BACE). A multicenter, randomized, double-blind, placebo-controlled trial. Am J Resp Crit Care Med. 2019;200(7):857–868. https://doi.org/10.1164/rccm.201901-0094OC
5. Cazzola M, Rogliani P, Ora J, Calzetta L, Lauro D, Matera MG. Hyperglycaemia and chronic obstructive pulmonary disease. Diagnostics (Basel, Switzerland). 2023;13(21):3362. https://doi.org/10.3390/diagnostics13213362
6. Cao X et al. Advances in traditional Chinese medicine for the treatment of chronic obstructive pulmonary disease. J Ethnopharmacol. 2023;307:116229. https://doi.org/10.1016/j.jep.2023.116229
7. Jiao J et al. The therapeutic effect of Xuanbai Chengqi decoction on chronic obstructive pulmonary disease with excessive heat in the lung and FU-organs based on gut and lung microbiota as well as metabolic profiles. J Chromatogr B Analyt Technol Biomed Life Sci. 2022;1198:123250. https://doi.org/10.1016/j.jchromb.2022.123250
8. Liu D, Zou Y, Wang Y, Investigation on the relationship between sleep quality and depression and anxiety in hospitalized patients with different levels of AECOPD. Comp Math Methods Med. 2022;2022:5901552. https://doi.org/10.1155/2022/5901552
9. Büyükbayram G, Yüceer Ö., Oymak FS. The relationship between serum uric acid levels and early mortality in chronic obstructive pulmonary disease cases during exacerbation. Sarcoidosis Vasc Diffuse Lung Dis. 2022;39(2):e2022014. https://doi.org/10.36141/svdld.v39i2.12127
10. Sandelowsky H et al. COPD—Do the right thing. BMC Fam Pract. 2021;22(1):244. https://doi.org/10.1186/s12875-021-01583-w
11. Shang B et al. Insights from the perspective of traditional Chinese medicine to elucidate association of lily disease and yin deficiency and internal heat of depression. Evid Based Complement Alternat Med (eCAM). 2020;2020:8899079. https://doi.org/10.1155/2020/8899079
12. Pratt AJ et al. Complexity in clinical diagnoses of acute exacerbation of chronic obstructive pulmonary disease. BMC Pulmon Med. 2023;23(1):298. https://doi.org/10.1186/s12890-023-02587-1
13. Sim YS, Lee JH, Lee EG, Choi JY, Lee CH, An TJ, et al. COPD exacerbation-related pathogens and previous COPD treatment. J Clin Med. 2022;12(1):111. https://doi.org/10.3390/jcm12010111
14. Qi R et al. The efficacy and safety of Xinjia Xuanbai Chengqi granules in acute exacerbation of COPD: A multicentre, randomised, double-blind, controlled trial. Evid Based Complement Alternat Med (eCAM). 2022;2022:7366320. https://doi.org/10.1155/2022/7366320
15. Jin J et al. Effectiveness of Xin Jia Xuan Bai Cheng Qi decoction in treating acute exacerbation of chronic obstructive pulmonary disease: Study protocol for a multicentre, randomised, controlled trial. BMJ Open. 2019;9(11):e030249. https://doi.org/10.1136/bmjopen-2019-030249
16. Niu Y et al. Effect of community-acquired pneumonia on acute exacerbation of chronic obstructive pulmonary disease. COPD. 2021;18(4):417–424. https://doi.org/10.1080/15412555.2021.1950664
17. Liu M, Hu R, Jiang X, Mei X. Coagulation dysfunction in patients with AECOPD and its relation to infection and hypercapnia. J Clin Lab Anal. 2021;35(4):e23733. https://doi.org/10.1002/jcla.23733
18. Tao L et al. Tong Sai granule improves AECOPD via regulation of MAPK-SIRT1-NF-κB pathway and cellular senescence alleviation. J Ethnopharmacol. 2023;314:116622. https://doi.org/10.1016/j.jep.2023.116622
19. Singh B, Kampani G, Lall B, Singh M. Study of inflammatory markers in chronic obstructive pulmonary disease. J Assoc Physicians India (JAPI). 2022;70(12):11–12. https://doi.org/10.5005/japi-11001-016
20. Di J, Li X, Xie Y, Yang S, Yu X. Procalcitonin-guided antibiotic therapy in AECOPD patients: Overview of systematic reviews. Clin Resp J. 2021;15(6):579–594. https://doi.org/10.1111/crj.13345
21. Chen X, Kang F, Lai J, Deng X, Guo X, Liu S. Comparative effectiveness of phlegm-heat clearing Chinese medicine injections for AECOPD: A systematic review and network meta-analysis. J Ethnopharmacol. 2022;292:115043. https://doi.org/10.1016/j.jep.2022.115043
22. Fernández-Jané C, Vilaró J. Acupoint transcutaneous electrical nerve stimulation in hospitalized COPD patients with severe dyspnoea: Study protocol for a randomized controlled trial. Trials. 2019;20(1):707. https://doi.org/10.1186/s13063-019-3757-x
23. Shao S, Zhang Z, Feng L, Liang L, Tong Z. Association of blood inflammatory biomarkers with clinical outcomes in patients with AECOPD: An 8-year retrospective study in Beijing. Int J Chron Obstruct Pulmon Dis. 2023;18:1783–1802. https://doi.org/10.2147/COPD.S416869