

Value of erythrocyte sedimentation rate and serum epo levels in evaluating the condition and prognosis of COPD in the elderly

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Abstract: To investigate the value of erythrocyte sedimentation rate (ESR) and serum EPO levels in evaluating the condition and prognosis of chronic obstructive pulmonary disease (COPD) in the elderly. 120 elderly patients with acute exacerbation of COPD admitted to our hospital from May 2016 to April 2019 were selected. Pulmonary function tests and CT scans were performed on all patients. According to Gold's guidelines for the diagnosis and treatment of chronic obstructive pulmonary disease, patients with different degrees of illness were divided into mild group, moderate group and severe group. The levels of EPO and ESR were measured in the morning after admission and the differences of EPO and ESR between the three groups were compared. The correlation between EPO, ESR and FEV₁% of lung function index was analyzed by linear correlation analysis. There was no significant difference in age, sex, BMI index and course of disease among the three groups ($P>0.05$); ESR and EPO increased in turn among mild, moderate and severe groups, while FEV₁% decreased in turn, with significant differences between the two groups ($P<0.05$). Negative correlation (r values were - 0.33, - 0.49, $P<0.05$). ESR and serum EPO levels can reflect the severity of COPD in elderly patients to some extent, and are negatively correlated with FEV₁% of lung function indicators, which can provide some clues to the condition and prognosis of COPD in elderly patients.

Keywords: Erythrocyte sedimentation rate, serum EPO, elderly COPD, condition, prognosis.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a chronic lung disease characterized by persistent airflow limitation. The airway and lungs have a chronic inflammatory response to toxic gases or particles, which promotes the progressive development of airflow limitation. Acute exacerbation or other complications may affect the severity and prognosis of the disease (Halpin *et al.*, 2017; Cassady *et al.*, 2019). The incidence and mortality of COPD are increasing year by year, which seriously threatens people's lives and health (Prudente *et al.*, 2018). The current Gold's guidelines for COPD diagnosis is still lung function examination, but it cannot fully reflect the disease and prognosis, and the Gold's guidelines recommend that the evaluation of the condition of COPD should include comprehensive lung function, clinical manifestations, acute exacerbation and comorbidities. In recent years, there have been more and more studies on the pathogenesis of COPD, whose condition is related to various inflammatory factors, erythropoietin (EPO) is one of them, and erythrocyte sedimentation rate (ESR) also tends to increase in patients with inflammation (Lipson *et al.*, 2017; Poole *et al.*, 2019). In this study, elderly patients with COPD were selected as the research subjects. By comparing the differences of EPO and ESR in elderly COPD patients with different disease grades, the evaluation value of EPO and ESR levels on the condition and prognosis of COPD was further discussed.

MATERIALS AND METHODS

General information

A total of 120 elderly patients with acute exacerbation of COPD admitted to our hospital from May 2016 to April 2019 were selected as the research objects, all patients passed the diagnosis of COPD after examination of symptoms, vital signs, chest CT, and lung function, and were all ≥ 60 years old. Exclusion criteria: women who were pregnant or breastfeeding; severe brain, liver, kidney and other insufficiency; people with cognitive impairment or mental illness; patients with pulmonary tuberculosis, bronchiectasis, lung cancer and other lung diseases. This experiment has been approved by the ethics committee of hospital, and all the patients included in the study have been informed and signed consent forms.

Research methods

All patients were tested for lung function after admission, using CHEST AC-8800 lung function tester (CHEST company, Japan). The patient rested for 30 minutes before the measurement, and then took a sitting position, and the 1 s forced expiratory volume (FEV₁) variability of the three lung functions was less than 5%. The highest value of FEV₁ was taken as the observation index, and the percentage of FEV₁ (FEV₁%) and forced vital capacity (FVC) were recorded.

A 64-slice spiral CT (Siemens, Germany) was used to scan the lungs of the patient. The patients took the supine position, who were scanned from head to toe, and instructed to hold their breath when inhaling deeply and completed the scan from the apex of the lung to the

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bottom of the lung. Then, observe whether the upper, middle and lower lung fields of the patient's left and right lungs were abnormal.

Blood samples were taken from the patients on an empty stomach early the next morning, and ESR was measured using an automatic hematology analyzer (Abbott CD3700). Serum was separated immediately after blood collection, and serum EPO was measured by radioimmunoassay. 2mL serum was taken and the EPO level was determined according to the operating instructions of the kit provided by Diagnostic Systems Laboratories (USA).

Evaluation criteria

Pulmonary function classification: Gold's guidelines classification was performed according to the patient's lung function test indicators FEV₁ / FVC and FEV₁%. Grade I (mild), FEV₁/FVC < 70%, FEV₁% ≥ 80%; grade II (moderate), FEV₁ / FVC < 70%, 50% ≤ FEV₁% < 80%; grade III (severe), FEV₁ / FVC < 70%, 30% ≤ FEV₁% < 50%; grade IV (extremely severe), FEV₁ / FVC < 70%, FEV₁% < 30% or FEV₁% < 50% with chronic respiratory failure.

CT imaging grading used Goddard score: observe the upper, middle and lower lung visual field of the left and right lungs respectively. 0 points: no abnormality; 1 point: abnormal ratio ≤ 25%; 2 points: abnormal ratio between 25% ~ 50%; 3 points: abnormal ratio between 50% ~ 75%; 4 points: abnormal ratio > 75. The sum of the scores of all regions was recorded as the total score. A total score of ≤ 8 was classified as mild, a total score of 9-16 was classified as moderate and a total score of > 16 was classified as severe.

Acute exacerbation stage classification (Jin *et al.*, 2016): the three main symptoms of patients with acute exacerbation of COPD were increased cough, increased sputum volume or accompanied by purulent mucous sputum, and increased dyspnea. These three symptoms simultaneously existed as severe COPD; the presence of the above two symptoms was moderate COPD; only one symptom was mild COPD.

According to the GOLD Chronic Obstructive Pulmonary Disease Diagnosis and Treatment Guidelines updated in 2014, all patients were graded based on the above three types of scores. According to the high severity of the single classification, the single classification was severe to be classified into the severe group and the three classifications were mild to be classified into the mild group.

Observation indicators

Statistics on the general conditions of patients in mild group, moderate group and severe group: age, gender, BMI index and course of disease. Compare the

differences of EPO, ESR and FEV₁% among the three groups of patients and analyze the correlation among lung function index FEV₁%, EPO, and ESR.

Statistical processing

SPSS21.0 software was used for statistical analysis, and the measurement data ($\bar{x} \pm s$) between the three groups was compared using single factor analysis of variance, T-test was used for comparison between two pairs, chi-square test was used for comparison of count data (%), linear correlation analysis was used for correlation analysis, and P < 0.05 was considered statistically significant.

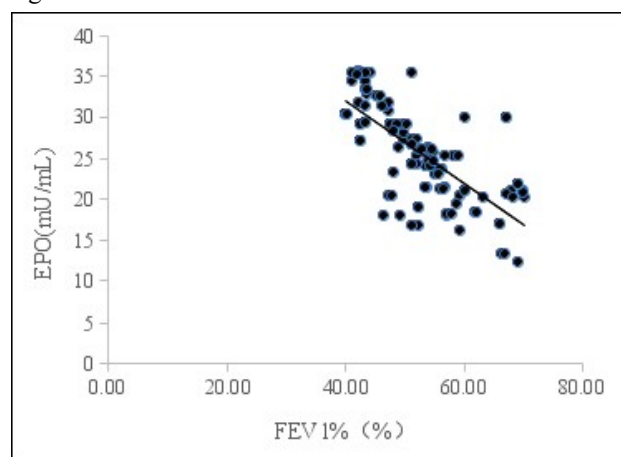


Fig. 1: Linear correlation analysis of EPO and FEV₁%

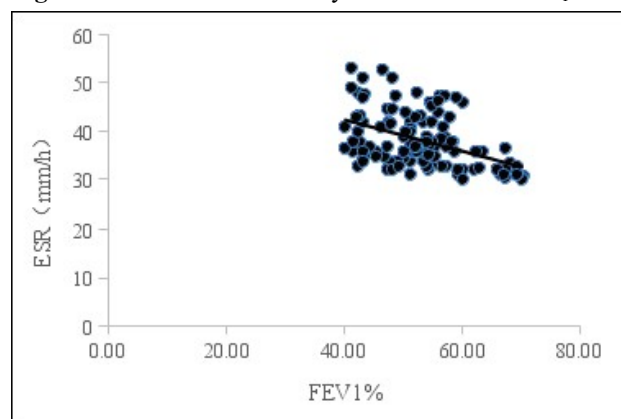


Fig. 2: Linear correlation analysis of ESR and FEV₁%

RESULTS

Comparison of the general conditions of the three groups of patients

The age, gender, BMI index, and the course of disease of the three groups of CPOD patients with different degrees of disease were compared, and there was no statistically significant difference (P > 0.05) (table 1).

Comparison of serum EPO and ESR levels in three groups of patients

Serum EPO and ESR levels in the mild group, moderate group and severe group showed an increasing trend, the

Table 1: Comparison of general conditions of three groups of patients ($\bar{x}\pm s/$ case, %)

Groups	Case	Age (years old)	Gender		BMI	Course of disease (year)
			Male	Female		
Mild group	56	68.24±6.35	37 (66.07)	19 (33.93)	23.75±3.21	12.76±8.17
Moderate group	41	67.83±7.22	25 (60.96)	16 (39.02)	24.19±3.08	12.13±9.41
Severe group	23	67.16±6.07	17 (73.91)	6 (26.09)	23.87±2.96	13.07±8.84
F/X ²		0.22	0.49		0.24	0.10
P		0.80	0.61		0.79	0.90

Table 2: Comparison of serum EPO and ESR levels in three groups ($\bar{x}\pm s$)

Groups	Case	EPO (mU/mL)	ESR (mm/h)	FEV ₁ %
Mild group	56	18.21±6.30	38.37±7.58	60.02±12.35
Moderate group	41	25.13±5.54 ^a	42.84±6.32 ^a	53.13±9.72 ^a
Severe group	23	28.45±7.12 ^{ab}	45.08±7.53 ^{ab}	46.85±6.84 ^{ab}
F		27.51	8.82	13.65
P		<0.01	<0.05	<0.01

Note: a: compared with the mild group, P <0.05, the difference is significant; b: compared with the moderate group, P <0.05, the difference is significant.

FEV₁% showed a decreasing trend in the mild group, moderate group, and severe group in turn, and the difference between the two groups was statistically significant (P <0.05) (table 2).

Correlation analysis of EPO, ESR and lung function index FEV₁%

A linear correlation analysis of serum EPO levels, ESR and FEV₁% of all patients found that EPO levels showed a significantly negative correlation with FEV₁% (r = -0.49, P <0.05), and ESR levels also showed a significant negative correlation with FEV₁% (r = -0.33, P <0.05) (figs. 1, 2).

DISCUSSION

COPD is a respiratory disease with a chronic inflammatory response throughout the body, it has a long course and cannot be completely cured and it requires long-term treatment, causing severe physical and mental injury and economic burden to patients (Hobbs *et al.*, 2017). At present, the diagnosis of COPD patients is still based on lung function tests, but lung function tests cannot fully reflect the condition and prognosis. The GOLD guidelines recommend a comprehensive assessment of the condition of COPD patients based on their lung function, clinical manifestations, acute exacerbations, and comorbidities. The Goddard study also points out that CT imaging grading has good stability and repeatability and can complement each other with lung function tests. Due to the relatively complicated condition of COPD, it is often combined with other complications, so the judgment of its condition is also a hot spot in clinical research (Duffy and Criner, 2019; Dean, 2017; Barrett *et al.*, 2019; Lareau *et al.*, 2019; Rabe and Watz, 2017).

The previous studies were consulted, noting that the two serological indicators EPO and ESR have a certain degree of connection with the condition of COPD patients (Mohan *et al.*, 2017; Papi *et al.*, 2018; Barnes, 2018). Therefore, by comparing the EPO and ESR indexes among elderly COPD patients with different disease grades, the evaluation value of ESR and serum EPO level in the elderly patients with COPD was explored.

The results showed that the levels of serum EPO and ESR showed an increasing trend in turn in patients with mild COPD, moderate COPD and severe COPD. EPO can promote the proliferation and differentiation of erythroid progenitor cells, and at the same time, as a survival factor to inhibit its apoptosis, it accelerated the proliferation of red blood cells, and promoted the maturation and release of reticulocytes (Prieto-Lloret *et al.*, 2015; Barnes, 2016; Sharma and Chakrabarti, 2016; Sala *et al.*, 2010; Sosnin *et al.*, 2018; Schumann *et al.*, 2006). The change of ESR reflected the degree of aggregation of red blood cells. The stronger the aggregation was, the faster the ESR was. The normal value was 0 to 15 mm / h in men and 1 to 20 mm / h in women (Lipson *et al.*, 2017). In COPD patients, due to the limited air flow, the low oxygen state in the blood will stimulate the kidney to produce EPO, thus promoting the bone marrow to generate red blood cells, while the increase of red blood cells will lead to a series of hemorheological changes, which will cause the increase of hematocrit, the thickening of blood, the suspension of red blood cells, and the difficulty of aggregation, and the ESR of ESR will increase accordingly (Fathy *et al.*, 2016; Mosrane *et al.*, 2017). The more serious the condition of COPD patients is, the more obvious the airflow restriction is, the lower the blood oxygen content is, and the greater the increase of EPO and ESR is.

FEV₁% represents the ventilation volume of the whole respiratory tract, reflecting the degree of airflow restriction in the lung, which can be used as a quantitative indicator of lung function. As the degree of airflow restriction deepened, the condition of COPD patients increased and FEV₁% decreased, reflecting the deterioration of lung function, which was consistent with the disease grade. The results showed that there was a significantly negative correlation between ESR and EPO and FEV₁%, indicating that the level of serum ESR and EPO can reflect the condition and prognosis of COPD patients to a certain extent.

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CONCLUSION

To sum up, ESR and serum EPO expression level can reflect the severity of the elderly COPD patients to a certain extent, and have a significant negative correlation with FEV₁% of pulmonary function index, which has a certain suggestive effect on the condition and prognosis of the elderly COPD. However, it is limited by the small number of cases in elderly COPD patients, which may lead to a certain degree of bias in the results. Therefore, this study can only be used as a preliminary study. In order to further verify the results of this study, the sample size needs to be expanded and a joint study with multiple centers should be conducted in the future.

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