

Correlation Analysis Between Changes of D-Dimer Level and Rheumatoid Arthritis Complicated with Interstitial Lung Disease

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Abstract: *Objective:* To explore the correlation between the change of D-dimer level and rheumatoid arthritis complicated with interstitial lung disease. *Methods:* From January 2022 to February 2024, 20 rheumatoid arthritis patients complicated with interstitial lung disease (interstitial lung disease group), 20 rheumatoid arthritis patients without interstitial lung disease (without interstitial lung disease group), and 20 healthy people (control group) in Xijing Hospital were selected for this study. The fasting venous blood of the three groups of subjects was collected and their D-dimer, C-reactive protein (CRP), rheumatoid factor (RF), and erythrocyte sedimentation rate (ESR) were detected. Subsequently, the correlation between each index and rheumatoid arthritis complicated with interstitial lung disease was analyzed. *Results:* The D-dimer level of the interstitial lung disease group was significantly higher than the other two groups ($P < 0.05$). The D-dimer level of the group without interstitial lung disease was significantly higher than the control group ($P < 0.05$). CRP levels in the interstitial lung disease group and the group without interstitial lung disease were significantly higher than those of the control group ($P < 0.05$). The ESR and RF levels of the interstitial lung disease group were significantly higher than the other two groups ($P < 0.05$). The levels of ESR and RF levels of the group without interstitial lung disease were significantly higher than the control group ($P < 0.05$). *Conclusion:* D-dimer levels of rheumatoid arthritis patients are higher than those of healthy individuals, and those complicated with interstitial lung disease present even higher levels. This finding shows that there is a correlation between D-dimer levels and rheumatoid arthritis with interstitial lung disease, which may facilitate the evaluation and diagnosis of this disease.

Keywords: D-dimer; Rheumatoid arthritis complicated with interstitial lung disease; ESR; Rheumatoid factor; Correlation analysis

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1. Introduction

The etiology of rheumatoid arthritis is complex, generally involving environmental factors, infections, and other elements that trigger autoimmune reactions and immune damage. The clinical manifestations vary greatly

among patients, but most experience joint swelling and tenderness, leading to joint dysfunction. Rheumatoid arthritis complicated by interstitial lung disease is a lung condition caused by an immune response. Patients with rheumatoid arthritis have a high risk of developing this lung condition. In the early stages, the symptoms of interstitial lung disease can be difficult to distinguish. As the disease progresses, the lung lesions worsen, causing inflammation in the alveolar cavity. This inflammation leads to a build-up of inflammatory factors and cell exudates in the alveoli, resulting in diffuse lung parenchymal lesions that impair lung function. This makes early detection and treatment crucial ^[1]. Currently, the clinical diagnosis of interstitial lung disease primarily relies on lung CT scans and pathological examinations. However, the early detection rate is low, often resulting in delayed treatment. Therefore, it is essential to explore simpler, more convenient, and efficient detection methods ^[2]. D-dimer is a specific degradation product formed in the human body, closely associated with pathological changes such as vascular endothelial injury. It serves as a biological marker in peripheral blood. Recent studies have indicated that D-dimer levels are closely related to rheumatoid arthritis complicated by interstitial lung disease. However, the precise nature of this correlation requires further clarification ^[3]. Therefore, from January 2022 to February 2024, we selected 20 rheumatoid arthritis patients complicated with interstitial lung disease, 20 rheumatoid arthritis patients without interstitial lung disease, and 20 healthy people in our hospital to analyze the correlation between the change of D-dimer level and rheumatoid arthritis complicated with interstitial lung disease.

2. Data and methods

2.1. General information

20 rheumatoid arthritis patients complicated with interstitial lung disease (interstitial lung disease" group), 20 rheumatoid arthritis patients without interstitial lung disease (without interstitial lung disease group), and 20 healthy people (control group) in Xijing Hospital were selected for this study. The interstitial lung disease group consisted of 11 males and 9 females, aged 42–78 years, with an average age of 59.93 ± 17.86 years. The group without interstitial lung disease included 12 males and 8 females, aged 42–79 years, with an average age of 60.48 ± 18.23 years. The control group had 12 males and 8 females, aged 41–79 years, with an average age of 59.92 ± 18.84 years. The general data of the three groups are comparable ($P > 0.05$).

2.2. Inclusion and exclusion criteria

Inclusion criteria: Complete clinical data of the interviewee, ability to cooperate with relevant inspections, being a first-time patient in Xijing Hospital, no use of anticoagulant or thrombolytic drugs in the past month, and signed informed consent from all patients. Exclusion criteria: Patients with chronic respiratory diseases such as chronic obstructive pulmonary disease, patients with thrombotic diseases, and patients with cardiovascular and cerebrovascular diseases.

2.3. Methods

Fasting venous blood samples from the three groups were collected for examination. The D-dimer levels were detected using the American Beckman AU5800 automatic biochemical analyzer, while the erythrocyte sedimentation rate (ESR) was determined using the ESR-30 automatic ESR dynamic analyzer. All reagents, quality control products, and calibration products were provided with the instruments. C-reactive protein (CRP) levels were measured using a specific protein analysis system. The rheumatoid factor (RF) levels were detected using latex-enhanced immunoturbidimetry with an RF detection kit.

2.4. Observation indicators

The D-dimer levels of the three groups were observed, along with measurements of CRP, ESR, and RF levels. The normal reference values are as follows: D-D: 0-200 $\mu\text{g/L}$; CRP: $< 10 \text{ mg/L}$; RF: $< 20 \text{ IU/L}$; ESR: Adult male (0–15 mm/h); adult female (0–20 mm/h)^[4]. Statistical analysis was performed using SPSS 21.0 software. Measurement data are presented as mean \pm standard deviation (SD) and analyzed using the F-test. Count data are presented as $[n (\%)]$, analyzed using the χ^2 test. Pearson correlation analysis was used to investigate the relationship between D-dimer levels and rheumatoid arthritis complicated by interstitial lung disease. A significance level of $P < 0.05$ was considered statistically significant.

3. Results

3.1. Comparison of D-dimer and related indicators

The D-dimer level of the interstitial lung disease group was significantly higher than the other two groups ($P < 0.05$). The D-dimer level of the group without interstitial lung disease was significantly higher than the control group ($P < 0.05$). CRP levels in the interstitial lung disease group and the group without interstitial lung disease were significantly higher than those of the control group ($P < 0.05$). The ESR and RF levels of the interstitial lung disease group were significantly higher than the other two groups ($P < 0.05$). The levels of ESR and RF levels of the group without interstitial lung disease were significantly higher than the control group ($P < 0.05$). Further details are shown in **Table 1**.

Table 1. D-dimer and related indexes (mean \pm SD)

Group	D-dimer ($\mu\text{g/L}$)	CRP (mg/L)	ESR (mm/L)	RF (IU/L)
Interstitial lung disease group	604.85 \pm 15.23	27.63 \pm 5.86	41.13 \pm 8.56	601.25 \pm 58.36
Without interstitial disease group	256.37 \pm 71.25	26.52 \pm 6.02	22.96 \pm 7.69	489.65 \pm 78.63
Control group	51.02 \pm 12.36	2.93 \pm 1.13	11.25 \pm 3.25	14.25 \pm 5.16
F	15.529	5.528	18.029	23.415
P	< 0.001	0.008	< 0.001	< 0.001

3.2. Correlation analysis

Pearson correlation analysis showed that D-D level, ESR, and RF were correlated with rheumatoid arthritis complicated with interstitial lung disease ($P < 0.05$). Further details are shown in **Table 2**.

Table 2. Correlation analysis of rheumatoid arthritis complicated with interstitial lung disease and various indexes (r)

Index	Correlation analysis index	
	r	P
D-dimer	0.326	0.008
CRP	0.102	0.518
ESR	0.529	0.004
RF	0.471	0.008

4. Discussion

Rheumatoid arthritis complicated by interstitial lung disease can trigger pulmonary inflammation, leading to the accumulation of macrophages. This process involves inflammatory factors and cellular exudates that damage alveolar walls, resulting in pulmonary reticular fibrosis and significant impairment of lung function. Without timely intervention, it can progress to pulmonary fibrosis, with a poor prognosis for patients^[5]. Severe interstitial lung disease in rheumatoid arthritis patients can lead to respiratory failure, indirectly contributing to patient mortality. While early-stage symptoms may be managed with glucocorticoids, their use comes with substantial adverse effects. High-resolution CT and other imaging techniques are effective in detecting lung lesions, yet early diagnosis remains challenging with a risk of misdiagnosis. Lung biopsy for pathological examination remains the gold standard but is invasive and unsuitable for early screening. Hence, there is a pressing need to explore safer, simpler, more efficient, and less invasive diagnostic methods^[6]. In recent years, there has been increasing interest in studying peripheral blood biomarkers for clinical diagnosis and treatment of rheumatoid arthritis. These biomarkers offer a simple, rapid, and safe means to observe disease activity and assess the risk of complications. Common biomarkers like CRP, ESR, and RF are widely used but can sometimes show limited sensitivity and variability in detection, prompting the search for more sensitive indicators^[7]. D-dimer, a serum inflammatory factor indicating vascular and tissue injury, is closely linked to arthritis activity and can effectively assess rheumatoid arthritis progression, though its role in evaluating interstitial lung disease remains unclear^[8]. Analyzing D-dimer levels alongside other biomarkers in different subjects revealed significantly higher CRP levels in both interstitial lung disease and non-interstitial lung disease rheumatoid arthritis groups compared to controls ($P < 0.05$). Specifically, D-dimer levels were notably elevated in patients with interstitial lung disease, distinguishing them from normal rheumatoid arthritis patients and healthy individuals. ESR and RF also exhibited substantial changes, although CRP differences were less pronounced. Consequently, this study further explored the correlation between each biomarker and interstitial lung disease in rheumatoid arthritis patients, highlighting a significant association with D-dimer levels that could aid early clinical screening. Combining D-dimer with ESR, RF, and other indicators allows for a more comprehensive analysis of disease progression and more accurate patient evaluation. Overall, elevated D-dimer levels, particularly in patients with rheumatoid arthritis complicated by interstitial lung disease, underscore its potential as a valuable biomarker for disease evaluation and diagnosis^[9].

Disclosure statement

The author declares no conflict of interest.

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