Discussion on the Correlation between Clinical Typing of Covid-19 Patients and Risk Factors and Peripheral Red Blood Cell Parameters

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To investigate the correlation between clinical typing of coronavirus disease-19 patients and risk factors (age, sex, underlying disease), hematocrit (packed-cell volume), mean erythrocyte volume, standard deviation of erythrocyte volume distribution width, variation coefficient of erythrocyte distribution width and other peripheral erythrocyte parameters. Retrospective analysis from January 2020 to March 2020 were coronavirus disease-19, 82 cases of patients, according to the hospital condition grading assessment can be divided into normal group and the normal group (including heavy type and critically ill patients), using R*C chi-square statistics of gender and the presence of basic diseases, the binary classification Logistic regression analysis statistic average age, red blood cells deposited (packed-cell volume), red blood cell volume, red blood cell volume distribution width standard deviation, red blood cell distribution width variation coefficient, determine the correlation between. There were differences in age and presence of underlying diseases ($p<0.05$); There were no significant differences in hematocrit (packed-cell volume) or mean erythrocyte volume between the normal and non-normal groups (including severe and critically ill patients) ($p<0.05$); There were differences in standard deviation and variation coefficient of erythrocyte distribution width between the normal group and the non-normal group (including severe and critical patients) ($p<0.05$). In coronavirus disease-19 patients, increased age, accompanied by underlying disease, decreased standard deviation of red blood cell volume distribution width, and increased variation coefficient of red blood cell distribution width are correlated with the severity of the disease to a certain extent, and can be used as one of the predictive indicators of the severity of the disease in coronavirus disease-19 patients.

Key words: Coronavirus disease-19, risk factors, peripheral erythrocyte parameters

According to the coronavirus disease-19 (COVID-19) Diagnosis and Treatment Protocol (trial version 7), the most common clinical manifestations of COVID-19 are fever, dry cough and fatigue, and some patients present with nasal congestion, runny nose, pharyngeal pain, myalgia and diarrhea[1].In severe cases, dyspnea usually occurs within a week of onset, and some patients may rapidly develop acute respiratory distress syndrome (ARDS), septic shock, metabolic acidosis that is difficult to correct, and coagulation dysfunction[2]. Wuhan No. 7 Hospital has been a designated hospital for the treatment of COVID-19 patients in Wuhan since January 25, 2020. The collected risk factors and peripheral blood red blood cell parameters of COVID-19 patients in Wuhan No. 7 Hospital were retrospectively analyzed to provide reference for the clinical treatment of COVID-19. A retrospective study was conducted to collect 82 patients who visited Wuhan no. 7 hospital on January 25, 2020 and March 20, 2020. Nucleic acid tests were performed on pharyngeal swabs and other specimens and confirmed to be positive for COVID-19, meeting the common diagnostic criteria for COVID-19. This study has passed the Hebei Cangzhou combine traditional Chinese and western medicine hospital ethics committee approval (batch number: 2020006), by using the past medical records during the outbreak of the new champions league, however, were retrospectively analyzed for protection requirements in Wuhan ward patients unable to sign the informed consent, and the plan does not involve the patient privacy, the results may provide a scientific basis for COVID-19, to promote the use of the approved can be exempted from informed consent. The diagnosis of the common type of COVID-19 is based on the diagnosis

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of COVID-19 Diagnosis protocol (Trial Version 5)[3]. Novel coronavirus nucleic acid test of each pharyngeal swab was positive; common type: with fever, respiratory symptoms; Imaging findings show signs of peneumonia. The 82 selected cases were divided into normal group and non-normal group (including severe and critical patients) according to the grading assessment of admission status. Age, hematocrit (packed-cell volume (PCV)), mean erythrocyte volume (MCV), standard deviation of erythrocyte volume distribution width (RDW-SD), and coefficient of variation of erythrocyte distribution width (RDW-CV) were analyzed. Age, hematocrit (PCV), mean erythrocyte volume (MCV), standard deviation of erythrocyte volume distribution width (RDW-SD), and variation coefficient of erythrocyte distribution width (RDW-CV) were statistically analyzed using SPSS Statistics 20.0 software and dichotomized Logistic regression analysis. $p<0.05$ was considered statistically significant. From January 25, 2020 to March 20, 2020, patients in The Seventh Hospital of Hubei Province were selected and confirmed to be positive for COVID-19 through nucleic acid tests on pharyngeal swabs and other specimens, which met the diagnostic criteria of Western medicine for COVID-19. A total of 82 patients were included in this study. The average age was (63.9±14.4) y, and there were 43 male patients (52.4 %).Among the 82 patients, 38 (46.3 %) had underlying diseases. As shown in Table 1. There were differences in age and presence of underlying diseases between the normal and non-normal groups (both severe and critically ill) ($p<0.05$); There were no significant differences in hematocrit (PCV) or mean erythrocyte volume (MCV) between the normal and non-normal groups (including severe and critically ill patients) ($p<0.05$); There were differences in standard deviation (RDW-SD) and coefficient of variation (RDW-CV) of erythrocyte distribution width between normal and non-normal groups (including severe and critical patients) ($p<0.05$). As shown in Table 2. There are no predictors of severity for COVID-19 patients. The Red Cell Distribution Width (RDW) is one of the commonly reported parameters in complete blood count (CBC), which reflects the heterogeneity of Red blood cell (RBC) volume. Studies have shown that increased erythrocyte distribution width is associated with lung diseases, such as community acquired pneumonia (CAP), Chronic obstructive pulmonary disease (COPD), pulmonary embolism (PE), etc.[4-6]. In this study, the correlation between clinical typing of COVID-19 patients and risk factors (age, sex, underlying disease), hematocrit (PCV), mean erythrocyte volume (MCV), standard deviation of erythrocyte volume distribution width (RDW-SD), variation coefficient of erythrocyte distribution width (RDW-CV) and other peripheral erythrocyte parameters was studied. It was found that in patients with COVID-19, increased age, accompanied by underlying disease, decreased standard deviation of red blood cell volume distribution width (RDW-SD), and increased variation coefficient of red blood cell distribution width (RDW-CV) were correlated with disease severity to some extent. These results can be used as one of the predicators of the severity of the disease in patients with RDW-SD and RDW-CV COVID-19. Literature reports suggest that the change of RDW has certain correlation with lung disease, such as chronic obstructive pulmonary disease (COPD), such as HuGP[7] based on 442 patients with chronic obstructive pulmonary diseases acute exacerbation of red blood cell distribution width 1 y of monitoring analysis, found that 13.75 % or higher red cell distribution width is 1 y independent risk factors for mortality, further confirmed that the red blood cell distribution width is patients with chronic obstructive pulmonary disease aggravated an independent predictor of mortality. Celik *et al.*[8] found that only erythrocyte distribution width was an independent predictor of pulmonary thromboembolism among hematological parameters, and the sensitivity and specificity of

TABLE 1: CORRELATION BETWEEN GENDER, PRESENCE OR ABSENCE OF UNDERLYING DISEASE AND SEVERITY OF COVID-19 ASSESSMENT IN 82 PATIENTS

Groups	Gender		Bastic diseases	
	Male	Female	Nothing	Exist
Ordinary	14	21	23	12
Not the ordinary	29	18	20	27
Combined	43	39	43	39
X^2	3.788		4.315	
p	0.052		0.038	

TABLE 2: CORRELATION AMONG AGE, VARIATION COEFFICIENT OF ERYTHROCYTE DISTRIBUTION WIDTH, HEMATOPOIESIS, STANDARD DEVIATION OF ERYTHROCYTE VOLUME DISTRIBUTION WIDTH, MEAN ERYTHROCYTE VOLUME AND SEVERITY OF DISEASE ASSESSMENT IN 82 PATIENTS WITH NEW CROWN

To observe	Partial regression coefficient	Standard error	p	OR
Age	0.053	0.021	0.012	1.054
RDW-CV	1.607	0.590	0.006	4.988
PCV	0.050	0.061	0.414	1.051
RDW-SD	-0.358	0.167	0.032	0.699
MCV	0.036	0.033	0.28	1.037

erythrocyte distribution width in predicting acute pulmonary thromboembolism were 20.7 % and 93.4 %. Braun *et al.*[9], such as the study analyzed retrospectively 3815 cases of adult patients with community-acquired pneumonia, found that higher red cell distribution width >15 % will increase significantly when the patient's 90 d mortality rate, and higher red cell distribution width will increase even more complex hospitalization (defined as at least one the following: hospital mortality rates, at least 10 d of hospital stay, ICU admission). It is mentioned in the COVID-19 Diagnosis and Treatment Protocol (trial version 8)[10] that the pulmonary pathology of COVID-19 patients shows different degrees of consolidation. The consolidation area mainly presents diffuse alveolar injury and exudative alveolitis. Lung lesions in different areas are complex and changeable, with new and old interlaced. Alveolar exudate and transparent membrane formation were observed. Exudate cells are mainly monocytes and macrophages. Hyperemia, edema, and mononuclear and lymphocytic infiltrates are seen in the alveolar septa. A few alveolar hyperinflation, alveolar septal rupture or cysts formed. Part of the epithelium of bronchial mucosa at all levels in the lung is exudated, and exudate and mucus can be seen in the cavity. The bronchioles and bronchioles are prone to mucous plug formation. Pulmonary vasculitis, thrombosis (mixed thrombus, clear thrombus), and thromboembolism are seen here. The lung tissue is prone to focal hemorrhage with hemorrhagic infarcts, bacterial and/or fungal infections. In a long course of illness, alveolar exudation (fleshy degeneration) and pulmonary interstitial fibrosis are seen[11-13]. These results suggest that patients with severe or severe COVID-19 are more likely to have aggravation of infection, obvious hypoxia, and thrombosis, and more likely to have increased erythrocyte distribution width. In our study, standard deviation (RDW-SD) and coefficient of variation (RDW-CV) of erythrocyte volume distribution width were selected, and the decrease of RDW-SD and the increase of RDW-CV were correlated with the severity of the disease to some extent. The standard deviation of the width of the RBC volume distribution reflects the variation of the RBC volume in the peripheral blood circulation, which may be increased by ineffective hematopoiesis (e.g., folic acid deficiency, vitamin B12 deficiency, iron deficiency) or by erythrocyte destruction (e.g., hemolysis, blood transfusion). Any pathologic change that may affect red cell maturation (e.g., nutritional deficiencies, hepatic and renal insufficiency, inflammatory response, and oxidative stress) can lead to an increase in the coeffocient of variation of erythrocyte distribution width. Meanwhile, RDW-CV can reflect the changes of red blood cell size over a long period of time[7].The change is a comprehensive response. This study is a single-center retrospective study with limited number of studies and follow-up time, which may be biased to some extent. Moreover, the causal relationship between erythrocyte distribution width and various traditional biological markers is still unclear, so the specific pathophysiological mechanism and predictive value of dynamic changes need to be further studied with larger samples. Although relevant studies on COVID-19 are still insufficient, clinicians should pay attention to patients with COVID-19 who continue to have a high distribution width of red blood cells, actively look for potential events such as infection, hypoxia and thrombosis, and actively intervene to reduce the chance of aggravation of the disease. The detection of red blood cell distribution width in blood routine is economical and convenient, which is expected to be a biological indicator to assess prognosis in the management of COVID-19 patients. In patients with COVID-19, increased age, accompanied by underlying disease, decreased standard deviation of red blood cell volume distribution width (RDW-SD), and increased variation coefficient of red blood cell distribution width (RDW-CV) are correlated with the severity of the disease to a certain extent, and can be used as one of the predictive indicators of the severity of the disease in COVID-19 patients.

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Conflict of interests

The authors declared no conflict of interest.

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