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BRIEF REPORT

WILEY

The diagnostic value of platelet distribution width in patients with mild COVID-19

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Abstract

COVID-19 has a worldwide distribution; however, there is no effective diagnosis marker, especially for the mild-type COVID-19. The purpose of the current study was to identify parameters for mild-type COVID-19. We retrospectively analyzed a single-center data of patients with mild COVID-19. Forty patients diagnosed with COVID-19 were enrolled. Peripheral blood indices between the admission and discharge times were collected and analyzed. The platelet distribution width (PDW) was shown to be an indicator of significant change. The receiver operating characteristic curve for PDW was 0.7; the sensitivity and specificity for PDW were 82.5% and 55.0%, respectively. Therefore, a potential diagnostic value of PDW for mild-type COVID-19 was demonstrated.

KEYWORDS
COVID-19, diagnosis, mild disease, PDW

1 | INTRODUCTION

Beginning in December 2019, some unusual pneumonia cases occurred in Wuhan, a central city located in the middle of China with a population of 11 million. The pneumonia spread throughout China, and at the same time, the pneumonia appeared worldwide.[1,2] By complete gene sequencing of alveolar lavage fluid, a β-coronavirus associated with human serious acute respiratory syndrome (SARS) was found. The source virus was named as SARS-CoV-2 and the pneumonia was named COVID-19.[2,3]

Because COVID-19 originated from a Huanan seafood market, infected animals were thought to be the viral host. SARS-CoV-2 was transmitted among people by coughing and sneezing with a potent infectivity like other viral pneumonias.[4] RT-PCR of SARS-CoV-2 is the gold standard to diagnose COVID-19. Of note, nucleic acid testing requires a long turnaround time, a confirmed P2 laboratory, expensive equipment, and skilled researchers.[5] Moreover, nucleic acid testing has a 20% false-positive rate.[6]

Currently, effective drugs and vaccines for the treatment of COVID-19 are limited. COVID-19 has three types according to the severity of disease: mild, serious, and critical. Patients infected with the serious and critical types have been the focus of clinicians and researchers due to the high mortality rate; patients with mild-type infections have mild symptoms and a good prognosis.[7] Nearly 50–75% of the COVID-19

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subjects are asymptomatic.[8] In this study, we kept a watchful eye on patients with mild-type infections. Because of the atypical symptoms, patients with mild-type infections are more likely neglected and post a threat to healthy people. We investigated meaningful parameters for the diagnosis of COVID-19 by analyzing routine blood testing results.

2 | MATERIALS AND METHODS

We retrospectively studied 40 patients who were confirmed to have SARS-CoV-2 infections at the Leishenshan Hospital in Wuhan. The enrolled patients had mild-type COVID-19 with hospital stays between February and May 2020. Patient age and sex were recorded.

According to the different indices of admission and discharge, the data were separated into admission and discharge groups. The white blood cell (WBC) count, red blood cell (RBC) count, hemoglobin (Hb) concentration, platelet (PLT) count, neutrophil (N) count, percentage of neutrophils (N %), lymphocyte (L) count, percentage of lymphocytes (L %), monocyte count, percentage of monocytes, neutrophil ratio (NR), mean platelet volume (MPV), platelet distribution width (PDW), alanine aminotransferase (ALT) concentration, aspartate amino transferase (AST) concentration, and γ-glutamyl transpeptidase (rGT) concentration were recorded.

The exclusion criteria were as follows: more than mild disease on admission and co-morbid diseases, such as hypertension, diabetes, and tumors.

Blood specimens were harvested into tubes containing potassium ethylenediaminetetraacetic acid (EDTA) after collection from the cephalic vein and analyzed on an automatic hematology analyzer.

The results of the sex- and age-matched healthy people were collected for receiver operating characteristic (ROC) curve analysis.

This research was approved by the Ethics Committee of The Second Affiliated Hospital of Dalian Medical University . Every patient signed an informed consent for using the medical data.

2.1 | Statistical analyses

Data were analyzed using SPSS 20.0 software. Continuous variables are shown as the mean ±standard error (SE). Paired *t* test analysis was performed to access the differences between the admission and discharge groups. The ROC curve was used to create the area under the curve (AUC). Statistical significance was considered to be a *p* value <0.05.

3 | RESULTS

The demographic data of the enrolled 40 patients are shown in Table 1. The mean age was 58.98 ± 14.15 years (range, 21–89 years); the number of males and females was equal. There were no serious- and critical-type patients, and there no patient deaths.

TABLE 1 Demographic data of enrolled patients

Parameters	
Age	58.98 ± 14.15 years
Sex (male/female)	20/20

TABLE 2 Laboratory examination changes for patients in the admission and discharge groups

	Admission group	Discharge group	*p* value
WBC ($\times 10^9$/L)	5.602 ± 1.47	5.273 ± 1.40	0.163
RBC ($\times 10^{12}$/L)	4.104 ± 0.586	4.22 ± 0.552	0.056
Hb (g/L)	125.9 ± 23.2	128.7 ± 15.9	0.281
PLT ($\times 10^9$/L)	241.1 ± 69.9	227.2 ± 56.4	0.198
N	3.27 ± 1.08	3.09 ± 0.92	0.204
N (%)	56.89 ± 11.657	54.255 ± 9.965	0.0624
L	1.682 ± 0.584	1.722 ± 0.557	0.467
L (%)	30.415 ± 8.56	32 ± 6.887	0.178
Monocyte	0.478 ± 0.170	0.479 ± 0.1762	0.985
Monocyte %	9.05 ± 2.534	9.26 ± 2.471	0.645
MPV (fL)	10.61 ± 1.44	10.52 ± 0.719	0.7458
PDW (fL)	11.75 ± 1.227	12.23 ± 1.485	0.0186*
ALT	27.915 ± 22.618	24.3 ± 9.149	0.2894
AST	23.83 ± 15.72	19.825 ± 3.814	0.0959
rGT	37.885 ± 40.911	33.55 ± 21.997	0.2962

Note: Only the change in PDW was significantly different between the two groups ($p < 0.05$); there were no obvious changes for the other indices ($p > 0.05$).

TABLE 3 Demographic data of healthy people

Parameters	
Age	53.35 ± 12.82 y
Sex (male/female)	20/20

Hematologic indices (WBC, RBC, Hb, PLT, N, N%, monocyte, monocyte %, MPV, PDW, ALT, AST, and rGT) at the time of admission and upon discharge were collected and analyzed (Table 2).

Based on the above research results, PDW was selected for further study. A control group comprised of 40 healthy people was assembled; the sex and age were matched with the COVID-19 patients. The admission and control groups had an equal variance. The control group demographic data are shown in Table 3.

The PDW changes between the admission and control groups are shown in Table 4. There was a significant difference between the two groups ($p < 0.05$).

The AUC of PDW was 0.70, the cutoff value was 12.7 fL, and the sensitivity and specificity were 82.5% and 55.0%, respectively (Table 5, Figure 1).

TABLE 4 PDW changes between the admission and control groups

	Admission group	Control group	*p* value
PDW (fL)	11.75 ± 1.227	13.18 ± 0.321	0.0003*

TABLE 5 Characters of ROC

Characteristic	
Area under the ROC curve (AUC)	0.70
Youden index J	0.375
Associated criterion	≤12.7
Sensitivity	82.5
Specificity	55.0

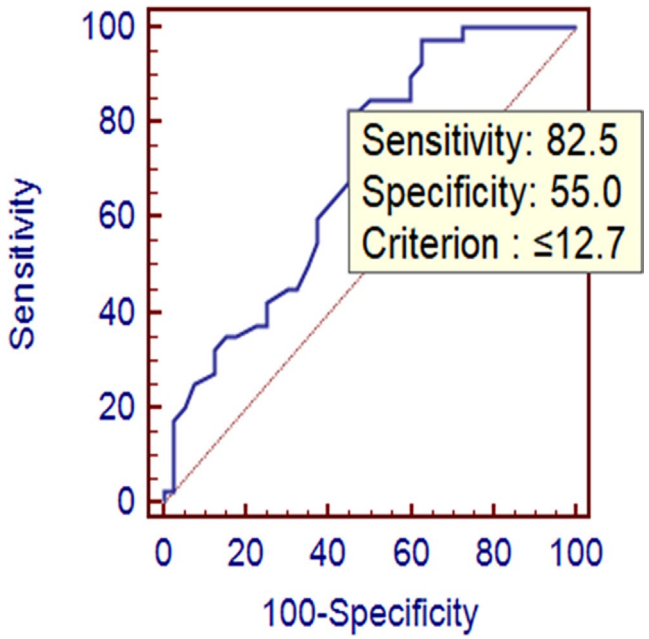

FIGURE 1 ROC curve of the PDW

4 | DISCUSSION

COVID-19 is a new pneumonia caused by infection with SARS-CoV-2, which is a member of β-coronaviruses; there are no standardized laboratory markers for diagnosing SARS-CoV-2.[9,10] The presentation of COVID-19 includes chills, respiratory symptoms, and diarrhea in the early stage, while multiple organ dysfunction syndrome (MODS), septic shock, and coagulation dysfunction characterize the serious stage.[11] Several studies have reported the hematologic parameters of serious and critical types of SARS-CoV-2 infections.[12-14] Lymphocyte and PLT counts are thought to be parameters reflecting the degree of infection and inflammation.[15] D-dimer and PLT counts have been shown to be indices for serious-type COVID-19 patients[10]; however, there has been no study focused on mild-type COVID-19.

We had planned to identify indices for the diagnosis of mild-type COVID-19 according to routine blood tests in the current study. Because some of the patients did not have all of the relevant laboratory test results, such as $CD4^+$ T cells, $CD8^+$ T cells, B cells, and NK cells,[15,16] more attention was paid to the serious-type COVID-19 patients.

Based on the present research, based on a comparison of the admission and discharge groups, only the change in PDW was significantly different between the two groups. PDW was then selected for further research. PDW was compared with the healthy group; the AUC of PDW was 0.7, and the cutoff value was ≤12.7 fL; thus, values of PDW <12.7 should suggest the possibility of COVID-19.

Platelets function in hemostasis, coagulation, innate immunity, and inflammatory responses.[15] PDW has been reported in patients with hemorrhagic fever with renal syndrome caused by Hantaan virus[17]; PDW has been suggested to be associated with coronary heart disease,[18] in chronic hepatitis B infection,[19] and in type 2 diabetes mellitus[20]; however, there are no reports involving PDW and COVID-19. We conclude that PDW changes occur in COVID-19 patients and demonstrate an association between the PDW and COVID-19 infections.

5 | CONCLUSION

In the study, we included 40 patients with confirmed COVID-19 infections from one center. The PDW was shown to be a potential marker for diagnosis of the mild-type of COVID-19. Indeed, the PDW from a routine peripheral blood examination could suggest SARS-CoV-2 infections to physicians when the value is ≤12.7 fL.

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CONFLICT OF INTEREST

None.

DATA AVAILABILITY STATEMENT

Data could be got from the corresponding author.

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REFERENCES

1. Li Q, Guan X, Wu P, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N Engl J Med*. 2020;382(13):1199-1207.
2. Zhu N, Zhang D, Wang W, et al. A Novel Coronavirus from Patients with Pneumonia in China, 2019. *N Engl J Med*. 2020;382(8):727-733.
3. Rothan HA, Byrareddy SN. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. *J Autoimmun*. 2020;109:102433.

4. Kermali M, Khalsa RK, Pillai K, Ismail Z, Harky A. The role of biomarkers in diagnosis of COVID-19 - A systematic review. *Life Sci*. 2020;254:117788.
5. Li Z, Yi Y, Luo X, et al. Development and clinical application of a rapid IgM-IgG combined antibody test for SARS-CoV-2 infection diagnosis. *J Med Virol*. 2020.92(9):1518–1524.
6. Ai T, Yang Z, Hou H, et al. Correlation of Chest CT and RT-PCR Testing in Coronavirus Disease 2019 (COVID-19) in China: A Report of 1014 Cases. *Radiology*. 2019;2020:200642.
7. Sun S, Cai X, Wang H, et al. Abnormalities of peripheral blood system in patients with COVID-19 in Wenzhou, China. *Clin Chim Acta*. 2020;507:174-180.
8. Aktas G. A comprehensive review on rational and effective treatment strategies against an invisible enemy; SARS Cov-2 infection. *Exp Biomed Res*. 2020;3(4):293-311.
9. Malik YS, Sircar S, Bhat S, et al. Emerging novel coronavirus (2019-nCoV)-current scenario, evolutionary perspective based on genome analysis and recent developments. *Vet Quarterly*. 2020;40(1):68-76.
10. Salamanna F, Maglio M, Landini MP, Fini M. Platelet functions and activities as potential hematologic parameters related to Coronavirus Disease 2019 (Covid-19). *Platelets*. 2020;31(5):627-632.
11. Mattiuzzi C, Lippi G. Which lessons shall we learn from the 2019 novel coronavirus outbreak? *Ann Transl Med*. 2020;8(3):48.
12. Chen G, Wu D, Guo W, et al. Clinical and immunological features of severe and moderate coronavirus disease 2019. *J Clin Invest*. 2020;130(5):2620-2629.
13. Lippi G, Plebani M, Henry BM. Thrombocytopenia is associated with severe coronavirus disease 2019 (COVID-19) infections: A meta-analysis. *Clin Chim Acta*. 2020;506:145-148.
14. Wong JEL, Leo YS, Tan CC. COVID-19 in Singapore-current experience: critical global issues that require attention and action. *JAMA*. 2020;323(13):1243-1244.
15. Qu R, Ling Y, Zhang YH, et al. Platelet-to-lymphocyte ratio is associated with prognosis in patients with coronavirus disease-19. *J Med Virol*. 2020.92(9):1533–1541.
16. Wang F, Nie J, Wang H, et al. Characteristics of peripheral lymphocyte subset alteration in COVID-19 pneumonia. *J Infect Dis*. 2020;221(11):1762-1769.
17. Xiude F, Zitong L, Shiqi F, et al. Platelet Distribution Width at First Day of Hospital Admission in Patients with Hemorrhagic Fever with Renal Syndrome Caused by Hantaan Virus May Predict Disease Severity and Critical Patients' Survival. *Dis Markers*. 2018;2018:1-8.
18. Sincer I, Mansiroglu AK, Erdal E, Cosgun M, Aktas G, Gunes Y. Could platelet distribution width predict coronary collateral development in stable coronary artery disease? *Northern Clin Istanbul*. 2020;7(2):112-117.
19. Karagoz E, Ulcay A, Tanoglu A, et al. Clinical usefulness of mean platelet volume and red blood cell distribution width to platelet ratio for predicting the severity of hepatic fibrosis in chronic hepatitis B virus patients. *Eur J Gastroenterol Hepatol*. 2014;26(12):1320-1324.
20. Zaccardi F, Rocca B, Pitocco D, Tanese L, Rizzi A, Ghirlanda G. Platelet mean volume, distribution width, and count in type 2 diabetes, impaired fasting glucose, and metabolic syndrome: a meta-analysis. *Diabetes Metab Res Rev*. 2015;31(4):402-410.

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