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Predictive Value of Hematological Parameters in Pregnant Women with Severe COVID-19 Associated with the Delta Variant of SARS-CoV-2

Gebelerde Delta Varyant SARS-CoV-2 Nedenli Ağır COVID-19 Öngörüsünde Hematolojik Değişkenlerin Yeri

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ABSTRACT

Introduction: *There are many uncertainties regarding the prognosis of COVID-19 in pregnant women. The present study aimed to investigate the relationship between severe COVID-19 during pregnancy associated with the delta variant of SARS-CoV-2 and hematological parameters, including white blood cell (WBC), platelet (PLT), neutrophil (N), lymphocyte (L), monocyte (M), mean platelet volume (MPV), neutrophil/lymphocyte ratio (NLR), platelet/lymphocyte ratio (PLR), lymphocyte/monocyte ratio (LMR), derived neutrophil-to-lymphocyte ratio (dNLR), red cell distribution width (RDW), plateletcrit (PCT), and platelet distribution width (PDW).*

Materials and Methods: *Data obtained from 54 pregnant women who required hospitalization due to COVID-19 associated with the delta variant of SARS-CoV-2 were retrospectively reviewed. The pregnant women were divided into two disease groups as severe (n= 16) and non-severe (n= 38). Intergroup analyses were conducted based on WBC, PLT, N, L, M, MPV, NLR, PLR, LMR, dNLR, RDW, PCT, and PDW parameters obtained from the hematological test done at the time of first admission.*

Results: *WBC, PLT, MPV, N, PCT, NLR, PLR, and dNLR levels were statistically significantly higher and the L and LMR levels were significantly lower in pregnant women with severe COVID-19. The odds ratio (OR) and area under the curve (AUC) values for all parameters were 1.764, 1.014, 1.620, 2.161, 350.81, 2.736, 1.016, 1.722, 0.0004, 0.412 and 0.903, 0.815, 0.818, 0.929, 0.910, 0.728, 0.985, 0.944, 0.828, 0.826 respectively. All parameters had a significant predictive value (AUC< 0.50) for the diagnosis of severe disease. PCT parameter had the greatest increase in the risk of severe disease (approximately 350 times higher), and the NLR variable (AUC= 0.985) had the best diagnostic performance.*

Conclusion: *It was concluded that WBC, PLT, MPV, N, L, PCT, NLR, PLR, LMR, and dNLR parameters could be used in the assessment of the risk of severe disease or in the diagnosis of severe COVID-19 in pregnant women positive for the delta variant. We believe that the cut-off values calculated for the parameters, which had a significant predictive value based on receiver operating characteristic analysis, would help our colleagues in order to predict the clinical course in symptomatic pregnant women.*

Key Words: *COVID-19; Delta variant of SARS-CoV-2; Pregnancy*

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ÖZ

Gebelerde Delta Varyant SARS-CoV-2 Nedenli Ağır COVID-19 Öngörüsünde Hematolojik Değişkenlerin Yeri

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Giriş: *Çalışmamızda gebelikte delta varyant SARS-CoV-2'ye bağlı ağır COVID-19 ile beyaz kan hücresi (WBC), trombosit (PLT), nötrofil (N), lenfosit (L), monosit (M), ortalama trombosit hacmi (MPV), nötrofil/lenfosit oranı (NLR), trombosit/lenfosit oranı (PLR), lenfosit/monosit oranı (LMR), türetilmiş-nötrofil/lenfosit oranı (d-NLR), kırmızı hücre dağılımı (RDW), trombosit yüzdesi-plateletcrit (PCT), ve trombosit dağılımı (PDW) gibi hematolojik değişkenler arasındaki ilişkinin araştırılması amaçlandı.*

Materyal ve Metod: *Delta varyant SARS-CoV-2'ye bağlı COVID-19 nedeniyle yatış ihtiyacı duyulan 54 gebenin verileri retrospektif olarak değerlendirildi. Gebeler ağır (n= 16) ve ağır olmayan (n= 38) hastalık grubuna ayrıldı. Gruplar arası analizler ilk başvuru anında alınan hemogram testindeki WBC, PLT, N, L, M, MPV, NLR, PLR, LMR, d-NLR, RDW, PCT ve PDW değişkenler üzerinden yapıldı.*

Bulgular: *Ağır COVID-19 gebelerde WBC, PLT, MPV, N, PCT, NLR, PLR ve dNLR değişkenlerinin istatistiksel olarak anlamlı yüksek, L ve LMR değişkenlerinin ise anlamlı düşük olduğu saptandı. Tüm değişkenler için OR ve AUC değerleri sırasıyla 1.764, 1.014, 1.620, 2.161, 350.81, 2.736, 1.016, 1.722, 0.0004, 0.412 ve 0.903, 0.815, 0.818, 0.929, 0.910, 0.728, 0.985, 0.944, 0.828 0.826 bulundu. Tüm değişkenlerin ağır hastalık tanısı için anlamlı öngörü değerine sahip olduğu (AUC< 0.50) saptandı. Ağır hastalık riskindeki (yaklaşık 350 kat ile) en yüksek artışın PCT değişkeninde yaşandığı ve NLR değişkeninin (AUC= 0.985) tanısal değer açısından en iyi performansı gösterdiği saptandı.*

Sonuç: *Delta varyant pozitif COVID-19 gebelerde ağır hastalık riskinin değerlendirilmesinde ya da ağır hastalık tanısında WBC, PLT, MPV, N, L, PCT, NLR, PLR, LMR ve dNLR değişkenlerinin kullanılabileceği sonucuna ulaşılmıştır. ROC analizi sonucu anlamlı öngörü değeri saptanan değişkenleri için hesaplanan cut-off değerlerinin semptomatik gebelerde klinik seyrin tahmin edilebilmesi açısından meslektaşlarımıza yardımcı olabileceğine inanıyoruz.*

Anahtar Kelimeler: *COVID-19; Delta varyant SARS-CoV-2; Gebelik*

INTRODUCTION

COVID-19 is a pulmonary disease with broad clinical spectrum that ranges from mild disease with flu-like symptoms such as fever, cough, shortness of breath, fatigue, and headache to critical disease associated with pneumonia and respiratory failure[1-3]. COVID-19, which was first discovered in Wuhan in December 2019 and declared a pandemic by the World Health Organization (WHO) in March 2020, remains a public health risk with several unknown aspects[4]. The causative pathogen, SARS-CoV-2, has survived until today by transforming into several variants with different characteristics via genetic mutations[5]. WHO classifies emerging SARS-CoV-2 variants based on the magnitude of harm associated with changes in contagiousness and virulence as well as resistance to treatment and vaccines. The variants that play a dominant role in the pandemic are classified as variants of concern (VOCs). Delta (B.1.617.2) variant has been classified as a VOC[6]. The delta variant of SARS-CoV-2 has been found to be more infective, have a higher viral load, and is more resistant to vaccines compared to other VOCs (alpha, beta, and gamma) due to a mutation in the spike protein that increases its affinity for the ACE-II receptor[7,8].

Tissue damage caused by SARS-CoV-2 induces a systemic inflammatory response (SIR) cascade, leading to excessive secretion of proinflammatory cytokines and activation of other proinflammatory cells, including macrophages and granulocytes. The severity of SIR determines the clinical prognosis of the disease[9]. A complete blood count test, which is widely available

and inexpensive, can be used to evaluate SIR. White blood cell (WBC), platelet (PLT), neutrophil (N), lymphocyte (L), monocyte (M), mean platelet volume (MPV), neutrophil/lymphocyte ratio (NLR), platelet/lymphocyte ratio (PLR), lymphocyte/monocyte ratio (LMR), derived NLR (dNLR), red cell distribution width (RDW), platelet percentage-plateletcrit (PCT), and platelet distribution width (PDW) parameters can be used as SIR markers[4,10,11].

Pregnant women are at a higher risk for viral infections. Pregnant women has had higher rates of COVID-19-induced pneumonia, respiratory support requirements, as well as hospital and intensive care unit (ICU) admissions than the general population[12-14].

Infection associated with the delta variant of SARS-CoV-2 poses a considerable risk for pregnant women because of its high virulence factor and increased vaccine resistance. SIR prediction through an examination of complete blood count parameters is regarded as a cost-effective method. The present study aimed to investigate the relationship between the clinical prognosis of the disease in pregnant women with COVID-19 infected with the delta variant of SARS-CoV-2 and certain parameters, including the WBC, PLT, N, L, M, MPV, NLR, PLR, LMR, dNLR, RDW, PCT, and PDW.

MATERIALS and METHODS

The present study was carried out at the Obstetrics and Gynecology Clinic of Diyarbakır Gazi Yasargil Training and Research Hospital, which served as a pandemic hospital and was a tertiary center. Data from 54 pregnant women infected with the delta variant of SARS-CoV-2 and hospitalized due to COVID-19 between June 2021 and December 2021 were reviewed retrospectively. Necessary permissions for conducting the present study were obtained prior to the commencement of the study, and the articles of the World Medical Association's Declaration of Helsinki on Ethical Principles for medical research involving human subjects were adhered to during the design and implementation (Decision no: 54, Date: 24.03.2022)

In this study, pregnant women diagnosed with COVID-19 associated with the delta variant of SARS-CoV-2 and admitted to hospital according to WHO guidelines were divided into two disease groups as severe and non-severe[15,16]. In accordance with the inclusion criteria, the severe disease group included pregnant women with tachypnea (respiratory rate≥ 30/min), hypoxia (SpO_2< 93%), a ratio of partial pressure arterial oxygen and fraction of inspired oxygen of (PaO_2/FiO_2) ≤300 mmHg obtained via blood gas analysis, and at least one of the following medical conditions: pulmonary or other organ deficiency or shock, which required ICU admission. Others were assigned to the non-severe group. Accordingly, the severe and non-severe disease groups consisted of 16 and 38 pregnant women, respectively. In the severe group, 12 pregnant women needed intensive care and five of them died. None of the pregnant women included in our study were vaccinated.

Nasopharyngeal swap samples were examined for SL452R mutations specific to the delta variant using the SARS-CoV-2 Emerging Plus kits (Bio-Speedy, İstanbul, Türkiye). Bio-Speedy® SARS-CoV-2 Emerging Plus kit, when used with vNAT® transfer tube, makes the sample ready for real time PCR in one minute and provides real time PCR result in less than 30 minutes protocol. All swap samples were examined in the laboratory of our hospital. Age, gestational week, laboratory test results, and clinical follow-up information of the pregnant women were retrieved from the hospital archive system. Gestational week was determined using ultrasound examination and confirmed by the last menstrual date or ultrasound examination in the first trimester. The results of complete blood count at the time of first admission were considered in this study. A complete blood count test was performed on all patients using the Mindray BC 600 brand automatic blood count device, which uses the laser and impedance technique. We accepted the manuscript reference ranges of Abbassi-Ghanavati M. as normal values for hematological parameters in third trimester pregnancy. Data regarding the WBC, PLT, N, L, M, MPV, RDW, PCT, and PDW parameters were retrieved from the

patients' records. NLR value was calculated as the ratio of neutrophil count to lymphocyte count, PLR value as the ratio of platelet count to lymphocyte count, LMR value as the number of lymphocytes to that of monocytes, and dNLR value as the ratio of neutrophil count to WBC–neutrophil difference. Considering that the blood parameters might vary by gestational trimester, pregnant women only in the singular and third trimesters were included in the study[17]. According to the exclusion criteria, pregnant women who were hospitalized due to an infection with a non-delta variant of SARS-CoV-2, pregnant women with a delta variant of SARS-CoV-2 who were hospitalized due to obstetric reasons other than COVID-19, pregnant women with previous COVID-19, pregnant women in their first or second trimester, pregnant women with multiple pregnancies and concomitant diseases (hypertension, preeclampsia, diabetes, or cholestasis), smokers, and pregnant women with a body mass index of ≥30 kg/m^2 were excluded from the study.

Statistical Analysis

Kolmogorov-Smirnov and Shapiro-Wilk tests were used to test normality. Appropriate test methods were selected according to the results. Continuous variables satisfying the assumption of normal distribution were compared using Student's t test and the others by using Mann-Whitney U test among categories of groups as severe and non-severe. Homogeneities of variances were tested by Levene test. Mean ± standard deviation and median (min-max) were given as descriptive statistics for these variables. Receiver operating characteristic (ROC) curves were used to describe and compare the performance of diagnostics value of variables as WBC, PLT, MPV, N, L, PCT, NLR, PLR, LMR and dNLR. The area under the corresponding curves was calculated and compared as described by Hanley and McNeil[18]. The areas under the curves were summarized with their standard errors and 95% confidence intervals and presented visually as a figure. For the variables whose diagnostic powers were found to be statistically significant, the cut-off points determined according to the Youden index were given together with the relevant sensitivity and specificity points. In order to define independent risk factors of outcome variables, we ran univariate logistic regression analyses and odds ratios with their confidence intervals calculated. P values less than 0.05 were considered statistically significant. IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp. Released 2019. Armonk, NY) package was used for all statistical methods. Despite the multicollinearity problem, multiple logistic regression analysis could not be applied because of the variables that derived from each other and sample size limitation.

RESULTS

There was no significant difference between the severe and non-severe disease groups in terms of age or gestational week (p= 0.525/0.43). While mean values of WBC, PLT, MPV, N, L, M, RDW, PCT, PDW, NLR, PLR, LMR, and dNLR were found respectively to be 7.12 ± 2.4, 200.88 ± 72, 8.87 ± 1.45, 5.72 ± 1.89, 1.06 ± 0.46, 0.3 ± 0.17, 14.12 ± 1.56, 0.2 ± 0.08, 16.28 ± 0.29, 6.03 ± 2.27, 211.78 ± 82.9, 4.21 ± 2.65, 4.36 ± 1.7 in the non-severe group, these values were found to be 13.96 ± 6.3, 309.89 ± 106.47, 10.94 ± 3.56, 12.19 ± 5.82, 0.47 ± 0.21, 0.25 ± 0.1, 13.37 ± 0.9, 0.28 ± 0.12, 16.33 ± 0.27, 29.03 ± 13.17, 791.01 ± 452.92, 2.15 ± 1.41, 8.04 ± 3.52 in the severe group, respectively. WBC, PLT, MPV, N, PCT, NLR, PLR, and dNLR levels were significantly higher in the severe disease group than in the non-severe group. L and LMR values were significantly lower in the severe disease group than in the non-severe group. There was no significant difference in terms of M, RDW, and PDW values between the severe and non-severe groups (Table 1).

Odds ratio (OR) was calculated based on the logistic regression analysis of the parameters with significant differences between the groups. OR values for WBC, PLT, MPV, N, PCT, NLR, PLR, dNLR, L and LMR parameters were 1.764, 1.014, 1.620, 2.161, 350.81, 2.736, 1.016, 1.722, 0.0004 and 0.412, respectively. A significant increase in the risk of severe disease was found to be associated with an increase in the levels of WBC, PLT, MPV, N,

Table 1. Age, gestational week, and laboratory data

	Non-severe (n= 38)		Severe (n= 16)		p
Age	30.04 ± 5.81	29.5 (17-42)	30.72 ± 6.3	29.5 (21-42)	0.525*
GW	32.65 ± 4.15	32 (25-39)	32.06 ± 2.24	31 (29-37)	0.43
WBC	7.12 ± 2.4	6.7 (2.1-13.5)	13.96 ± 6.3	12.32 (6.53-32.51)	**<0.001**
PLT	200.88 ± 72	194 (90-450)	309.89 ± 106.47	286 (173-529)	**<0.001**
MPV	8.87 ± 1.45	9.35 (5.7-11.4)	10.94 ± 3.56	11.8 (1.8-14)	**<0.001**
N	5.72 ± 1.89	5.55 (2.7-11.4)	12.19 ± 5.82	10.7 (5.7-30)	**<0.001**
L	1.06 ± 0.46	0.9 (0.5-2.2)	0.47 ± 0.21	0.4 (0.2-0.9)	**<0.001**
M	0.3 ± 0.17	0.24 (0.11-0.82)	0.25 ± 0.1	0.26 (0.13-0.52)	0.55
RDW	14.12 ± 1.56	13.7 (12.3-18.9)	13.37 ± 0.9	13.35 (12.2-14.8)	0.092
PCT	0.2 ± 0.08	0.19 (0.09-0.51)	0.28 ± 0.12	0.24 (0.16-0.55)	**0.005**
PDW	16.28 ± 0.29	16.3 (15.8-17)	16.33 ± 0.27	16.3 (15.8-16.9)	0.413
NLR	6.03 ± 2.27	5.7 (2.5-10.5)	29.03 ± 13.17	30.38 (8.55-56.7)	**<0.001**
PLR	211.78 ± 82.9	207.25 (80.5-432)	791.01 ± 452.92	644.25 (208-1725)	**<0.001***
LMR	4.21 ± 2.65	3.5 (0.92-16.9)	2.15 ± 1.41	1.6 (0.96-6.6)	**<0.001**
dNLR	4.36 ± 1.7	4.07 (1.61-8.37)	8.04 ± 3.52	7.47 (2.75-14.1)	**<0.001**

Mean ± standard deviation and median (min-max.)* represent the parametric test results.
p values expressed by the * sign are valid for the comparisons as a result of the Student's t-test in cases of normal distribution by groups. All the others are p values, which were found using the Mann-Whitney U test. GW: Gestational week.

PCT, NLR, PLR, and dNLR parameters and a decrease in the levels of L and LMR parameters. PCT variable had the highest risk ratio, with an approximately 350-fold increase in the risk of severe disease versus one-unit increase (Table 2).

Predictive power of the parameters with significant differences between the groups was examined in relation to the diagnosis of severe disease. Areas under the receiver operating characteristic (ROC) curve (AUC) values for WBC, PLT, MPV, N, L, PCT, NLR, PLR, LMR and dNLR parameters were calculated as 0.903, 0.815, 0.818, 0.929, 0.910, 0.728, 0.985, 0.944, 0.828 and 0.826 respectively, and it was observed that all parameters had a significant predictive value for disease diagnosis. The NLR variable had the best performance in terms of diagnostic value with an AUC of 0.985. Unlike other parameters (WBC, PLT, MPV, N, PCT, NLR, PLR and dNLR), the increased

Table 2. Univariate logistic regression results for significant variables

Variables	B	S.E.	p	OR	95% CI
WBC	0.567	0.151	**<0.001**	1.764	1.313-2.370
PLT	0.014	0.004	**0.001**	1.014	1.006-1.022
MPV	0.482	0.164	**0.003**	1.620	1.175-2.232
N	0.770	0.199	**<0.001**	2.161	1.462-3.194
L	-7.816	2.109	**<0.001**	0.0004	0.000-0.025
PCT	8.163	3.114	**0.009**	350.81	7.847-1658.78
NLR	1.007	0.527	**0.005**	2.736	0.974-7.686
PLR	0.016	0.005	**0.001**	1.016	1.006-1.026
LMR	-0.887	0.294	**0.003**	0.412	0.232-0.732
dNLR	0.543	0.147	**<0.001**	1.722	1.290-2.297

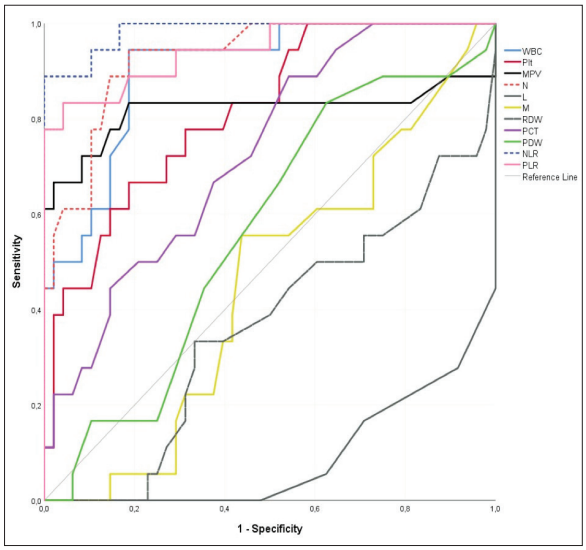

Figure 1. The receiver operating characteristic (ROC) curves are intended to describe and compare the performance of the diagnostic value of the parameters.

values of the L and LMR variables were protective. Therefore, the L and LMR parameters were highlighted by displaying them below the reference line (Figure 1). The cut-off values for severe disease diagnosis based on the Youden index were calculated as follows: WBC> 8.5 (94.44% sensitivity, 81.25% specificity), PLT> 255 (66.67% sensitivity, 81.25% specificity), MPV> 10 (83.33% sensitivity, 81.25% specificity), N> 6.7 (94.44% sensitivity, 81.25% specificity), L≤ 0.5 (72.22% sensitivity, 91.67% specificity), PCT> 0.18 (88.89% sensitivity, 45.83% specificity), NLR> 10.5 (88.89% sensitivity, 100% specificity), PLR> 346.1 (83.33% sensitivity, 95.83% specificity), LMR≤ 2.11 (72.22% sensitivity, 89.59% specificity), and dNLR> 4.88% (77.78% sensitivity, 72.92% specificity). WBC and N parameters had the highest sensitivity and NLR parameter had the highest specificity among the cut-off values calculated for the diagnosis of severe disease (Table 3, Figure 1).

DISCUSSION

Complete blood count parameters- both alone and in proportion to each other (NLR, LMR, PLR, etc.) are used as significant markers for the evaluation of SIR in cancer, immune disorders, and many diseases associated with inflammation[19,20].

A recent study on COVID-19-related mortality has reported that increased WBC, N, NLR and dNLR values are associated with mortality, but there is no relationship between mortality and the L, PLT and PLR values[21]. Another study has reported that WBC, N, NLR, dNLR and PLR values are significantly increased in symptomatic patients with COVID-19, and there is a positive relationship between NLR and COVID-19-related pneumonia[22].

While there are few studies with a similar design in the relevant literature on COVID-19 during pregnancy, there was no similar study solely on pregnant women with delta variant-positive COVID-19.

Shi et al. have found a significant elevation in the number of neutrophils and a significant decrease in the number of lymphocytes in pregnant women with COVID-19, but have

Table 3. Results of receiver operating characteristic (ROC) analysis for the diagnosis of severe disease

	AUC	Std. Error	p	95% CI	Sensitivity	Specificity	Cut-off
WBC	0.903	0.039	**<0.001**	0.826-0.979	94.44	81.25	>8.5
PLT	0.815	0.056	**<0.001**	0.705-0.926	66.67	81.25	>255
MPV	0.818	0.083	**<0.001**	0.656-0.981	83.33	81.25	>10
N	0.929	0.032	**<0.001**	0.867-0.992	94.44	81.25	>6.7
L	0.910	0.038	**<0.001**	0.814-0.967	72.22	91.67	≤0.5
PCT	0.728	0.066	**0.005**	0.599-0.857	88.89	45.83	>0.18
NLR	0.985	0.012	**<0.001**	0.961-1.000	88.89	100	>10.5
PLR	0.944	0.033	**<0.001**	0.879-1.000	83.33	95.83	>346.1
LMR	0.828	0.064	**<0.001**	0.715-0.910	72.22	89.59	≤2.11
dNLR	0.826	0.059	**<0.001**	0.712-0.941	77.78	72.92	>4.88

not clarified the relationship between laboratory parameters and clinical prognosis[23]. Another study on 110 pregnant women with COVID-19 conducted by Arslan et al. has reported that NLR value has a significant predictive power (AUC= 0.757) for severe disease diagnosis[24]. In their study involving 498 pregnant women with COVID-19, Lasser et al. have reported that lymphocyte count and NLR have significant predictive power for severe disease. According to ROC analysis of L and NLR parameters in the diagnosis of severe disease, the cut-off values have been found as L< 1.49 × 10^9/L (96% sensitivity, 52% specificity and AUC= 0.80) and NLR> 8.1 (100% sensitivity, 70% specificity and AUC= 0.86) respectively[25]. Another study comparing 53 pregnant women with COVID-19 to 24 pregnant women without COVID-19 has reported no significant difference in terms of NLR value between the groups, whereas PLR value has been found significantly higher in patients with severe disease and PLR has been determined to be more practical compared to NLR in the diagnosis of severe disease[26]. It has been reported that WBC and PLT values remain within normal limits in pregnant women with COVID-19[27]. In another study on the predictability of prognosis due to COVID-19, a significant association has been reported between mortality and high MPV and RDW values[28]. No similar studies have been found in the literature regarding PCT, PDW, M values and the prognosis of COVID-19 at pregnancy. However, a significant association has been reported between PCT increase and inflammatory diseases in adults[29]. Similarly, it has been reported that platelet distribution width (PDW) and plateletcrit (PCT) values are significant in predicting severe sepsis and mortality in children[30]. There are studies on the usability of monocyte count (M) in the evaluation of the inflammatory process[31].

In the present study, there was a significant increase in the WBC, PLT, MPV, N, PCT, NLR, PLR and dNLR parameters and a significant decrease in the L and LMR parameters in the pregnant women included in the severe disease group compared to those in the non-severe disease group. There was no significant relationship between the M, RDW and PDW parameters and severe disease.

It was found that the WBC, PLT, MPV, N, PCT, NLR, PLR, dNLR, L and LMR parameters were significantly associated with the risk of severe disease, and the highest risk was observed in the PCT parameter, with an approximately 350-fold increase.

Upon ROC analysis, it was found that the WBC, PLT, MPV, N, L, PCT, NLR, PLR, LMR and dNLR parameters had a significant predictive value in the diagnosis of severe disease. NLR variable had the highest predictive power for the diagnosis of severe disease, with the largest area under the ROC curve.

The present study's retrospective design is one of its limitations. The inability to make comparisons with healthy pregnant women in our study is another limitation of the study. In addition, using only anamnesis information for previous diagnosis of COVID-19 and the absence of serological investigation of possible anti-SARS-CoV-2 Igm and IgG positivity are limitations to the study. Although there were similar studies in the relevant literature that used complete blood count parameters to predict the clinical prognosis of COVID-19, to the best of our knowledge, there was no study that solely investigated delta variant-positive pregnant women. This makes the present study unique and impactful.

CONCLUSION

It was concluded that the WBC, PLT, MPV, N, L, PCT, NLR, PLR, LMR and dNLR parameters could be used in the assessment of the risk of severe disease or in the diagnosis of severe COVID-19 in pregnant women positive for the delta variant. We believe that the cut-off values calculated for the WBC, PLT, MPV, N, L, PCT, NLR, PLR, LMR and dNLR parameters, which had a significant predictive value based on ROC analysis, would help our colleagues in order to predict the clinical course in symptomatic pregnant women.

ETHICS COMMITTEE APPROVAL

This study was approved by Health Sciences University Gazi Yaşargil Training and Research Hospital Clinical Research Ethics Committee (Decision no: 54, Date: 24.03.2022).

CONFLICT of INTEREST

None of the authors had conflict of interest.

AUTHORSHIP CONTRIBUTIONS

Concept and Design: MRG, ŞT

Data Collection or Processing: ŞT

Analysis/Interpretation: MRG, ŞT

Literature Search: MRG, ŞT

Writing: MRG, ŞT

Final Approval: MRG, ŞT

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