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Comparison of complete blood count parameters of panic attack and panic disorder

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Abstract

Although complete blood count (CBC) parameters in panic disorder (PD) are frequently studied, there is no data on panic attacks (PA). In this retrospective study, CBC parameters of patients diagnosed with PD (n=63) and PA (n=61) were compared with the data of healthy subjects (n=41). The groups were similar in terms of age (p=0.395) and gender (p=0.567). There were significant differences between the PD and the PA groups in terms of percentage of lymphocyte (p<0.001), lymphocyte count (p<0.001), neutrophil to lymphocyte ratio (p<0.001), platelet to lymphocyte ratio (p<0.001), basophil to lymphocyte ratio (BLR) (p<0.001), and monocyte to lymphocyte ratio (MLR) (p<0.001). Our findings suggested that the lymphocyte parameters were significantly higher and lymphocyte-related ratios were significantly lower in the PA group compared to the control and PD groups. Low basophil parameters were suggested to be significantly associated with PA, while neutrophil-related parameters were significantly increased in PD.

Keywords: Panic attack, panic disorder, lymphocyte, neutrophil, complete blood count

Introduction

The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) defines a panic attack (PA) as "an abrupt surge of intense fear or intense discomfort that reaches a peak within minutes." DSM-5 criteria for panic disorder (PD) include the experiencing of recurrent PAs, with one or more attacks followed by at least one month of fear of another PA or significant maladaptive behavior related to the attacks [1]. The lifetime prevalence of PAs is 13.2%. Among persons that ever had a PA, the majority had recurrent PAs, while only 12.8% fulfilled DSM-5 criteria for PD. Lifetime prevalence estimates were 1.7% for PD [2]. PA is one of the most often forms of anxiety, while PD is often a chronic condition. There may be differences between the complete blood count (CBC) parameters of acute and chronic diseases [3-6].

CBC is the most common laboratory test performed today [7]. It gives information about the production of all blood cells [8]. As with other psychiatric disorders [9-11], CBC parameters in PD were frequently studied [12-19].

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Red blood cell distribution width_coefficent of variation (RDW_CV) is the most emphasized parameter in these studies [16,17]. While Hamzekolaei et al. [17], Ransing et al. [18], and Asoglu et al. [16] reported an increase in RDW_CV, Gunduz et al. [19] and Gogcegoz-Gul et al. [14] did not report any significant alterations. Mean platelet volume (MPV) is another frequently studied marker in PD [14,15]. Some studies reported a significant decrease in PD compared to the control group [14,17,18], while others reported a significant increase [15,16]. According to the majority of studies, there is no significant difference between PD and healthy controls in terms of hemoglobin (HGB), platelet count (PLT), and mean corpuscular volume (MCV) values [12,14,19]. Studies on immune cell and lymphocyte-related ratios are limited. Gunduz et al. [19] reported that the lymphocyte count (LYM) increased in PD compared to the control group, Gurok et al. [12] reported that the LYM decreased. Both studies [12,19] stated that the neutrophil count (NEU) was similar between the PD and the control groups. Gunduz et al. [19] also did not find significance between the groups in terms of neutrophil to lymphocyte ratio (NLR), platelet to lymphocyte ratio (PLR). When studies investigating the relationship between PD and CBC are examined, it is seen that various findings are noticeable, and some CBC parameters have not been studied yet. According to our best knowledge, there are no studies on immune cell percentages, monocyte to lymphocyte ratio (MLR), eosinophil to lymphocyte ratio (ELR), basophil to

lymphocyte ratio (BLR). Also, considering that PD is a psychiatric disorder with high chronicity, and PA is an acute condition seen in PD, the hypothesis that CBC parameters will differ between these two conditions has come to mind. It was hypothesized that the differences between CBC values in PD reported in the literature may be due to the blood of attack or non-attack period. In this study, we aimed to compare the CBC parameters of PA, PD, and healthy control groups, especially lymphocyte-related ratios, percentages of immune cells.

Materials and Methods

Study Population

In this retrospective study, CBC parameters, especially white blood cell (WBC), red blood cell (RBC), HGB, hematocrit (HTC), MCV, mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), RDW_CV, PLT, platelet distribution width (PDW), plateletcrit (PCT), MPV, NEU, LYM, and lymphocyte-related ratios, of patients diagnosed with PD and PA, were compared with the data of healthy subjects who were similarly distributed regarding age and gender. The control group consisted of healthy volunteers without a history of a PA and PD who were recruited from the hospital staff. When the number of cases in both patient groups reached 60's, a power analysis was performed, and the study was terminated because it was over 80.0%. This study was conducted in the psychiatry outpatient clinic of Kahta State Hospital. All the data of the study were obtained by the sole author. Consulted patients are also evaluated by the same physician. The interviews were conducted in an environment suitable for psychiatric examination. The diagnosis was made by the sole physician/author who conducted the interview. Panic attack and panic disorder states were determined according to DSM-5. Although the interviews did not include a structured scale, they included a detailed mental state examination. In addition to clinical judgment, patients with additional psychiatric disorders according to DSM-5 were not included in the study. Local ethics committee approval was obtained, and all study participants provided written informed consent (2020/3-23).

Inclusion Criteria

Patients with PD and PA who were diagnosed according to the DSM-5 [1] criteria were included. According to verbal statements and the ministry of health (e-Nabız) records, individuals who had not received long-term medical treatment for any condition in the past were included in the study. The entire PA group had the first attack and the PA group was directed from the emergency department. The blood of PA patients was taken before any treatment intervention in the first half-hour of the attack. PD group consisted of patients who applied directly to the psychiatric outpatient clinic. PD patients who had their most recent attack one week earlier were included in the study.,

Exclusion Criteria

Twenty-two patients with a benzodiazepine (BZD), 27 patients with an antidepressant (AD), 2 patients with antipsychotic (AP), 9 patients with AD plus AP, 7 patients with BZD plus AD, 1 patient with AD plus AP plus BZD, 3 patients with illicit drug use, 2 patients with ethyl alcohol use, and 15 patients with non-psychotropic drug use were excluded from the study. Individuals who had incomplete CBC information according to the patient registry system, patients with recurrent attacks were not included in the study. In this way, 21 patients were excluded from the study. Eight PD patients with attack symptoms were excluded. Patients –in total, 12 patients– who had a comorbid additional psychiatric diagnosis, hypertension, diabetes mellitus, severe neurological, immunological or systemic diseases, asthma, chronic obstructive lung diseases, cardiovascular disease, malign conditions according to the patient registry system were excluded. The group of healthy controls did not have any psychiatric diagnosis and systemic diseases which may affect the results. For the control group, in addition to the verbal statement, their consent was obtained and e-Nabız records were reached; It was confirmed that there was no previous chronic disease history. The physician who conducted the study confirmed that there was no infection, especially an upper respiratory tract infection, at present.

Statistical Analysis

Group sample sizes of 63 and 61 achieve 99.999% power to detect a difference of $\mu1 - \mu2 = 29.0 – 35.7 = -6.7$ using a two-sided Mann-Whitney U or Wilcoxon Rank-Sum test assuming that the actual data distribution is double exponential when the significance level (alpha) of the test is 0.150 and the standard deviation is 8.0 in both groups. Version 22.0 of SPSS (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp) was used for all statistical analyses.

The numerical data were expressed as means and standard deviations, and the categorical data were expressed as frequencies and percentages. Normal distribution suitability was assessed using visual and analytical methods (Kolmogorov–Smirnov/Shapiro–Wilk test). Student's t-test was used for normal distributions, and one-way ANOVA was used for three independent groups. Mann–Whitney U test and Kruskal Wallis test was used for those with no normal distribution. A posthoc Tukey Honestly Significant Difference test was used when a significant difference was found between the three independent groups.

The relationship between the variables was assessed by the Spearman correlation test. Receiver operating characteristic (ROC) curve analysis was used to measure the diagnostic value of LYM, RDW_CV, NEU. Binary logistic regression analysis was used. A value of less than 0.05 was considered statistically significant.

Results

PD group consisted of 63 (38 females, 25 males) subjects, PA group 61 (31 females, 30 males) subjects, and the control group consisted of 41 (23 females, 18 males) subjects (p=0.567). The mean age was 32.77 ± 9.19 years in the PD group, 30.54 ± 8.75 years in the PA group, and 32.02 ± 9.42 years in the control group (p=0.395). A comparison of the CBC values of the PD, PA, and control groups were given in Table 1. In Table 1, the groups that led to significant differences were specified (e.g., while there were significant differences between PD and control groups –expressed with the exponential numeral of "1"– and between PA and control groups –expressed with the exponential numeral of "2"– in terms of WBC, there is no significant difference between PD and PA groups.).

Table 1. Comparison of CBC Values of PD, PA, and Healthy Control Groups

	PD (n=63) Mean ± SD	PA (n=61) Mean ± SD	Control (n=41) Mean ± SD	p-value	η^2
Age (years)	32.78 ± 9.19	30.54 ± 8.75	32.02 ± 9.42	0.395	0.012
WBC (103/uL)	8.82 ± 2.58[1]	9.41 ± 2.71[2]	7.24 ± 1.31[1,2]	<0.001*	0.113
RBC (106/uL)	5.39 ± 0.52[1]	5.69 ± 0.68[1]	5.43 ± 0.91	0.036*	0.039
HGB (g/dL)	14.12 ± 2.13	13.58 ± 2.17	13.81 ± 2.31	0.345	0.012
HTC (%)	43.91 ± 6.38	45.34 ± 6.00	44.75 ± 6.15	0.602	0.010
MCV (fL)	81.99 ± 6.63	79.26 ± 6.11	80.95 ± 6.22	0.023*	0.035
MCH (pg)	25.85 ± 3.10[1]	23.51 ± 2.89[1]	24.70 ± 3.43	<0.001*	0.097
MCHC (g/dL)	31.38 ± 2.08[1]	29.45 ± 1.92[1]	30.47 ± 2.32	<0.001*	0.141
RDW_CV (%)	11.84 ± 1.69[1,2]	11.05 ± 1.33[1]	11.07 ± 0.82[2]	<0.001*	0.071
PLT (103/uL)	272.56 ± 73.94	266.96 ± 72.66	255.95 ± 78.08	0.265	0.008
PDW (fL)	19.80 ± 1.27[1]	19.20 ± 1.11[1]	19.74 ± 1.13	0.006*	0.054
PCT (%)	0.21 ± 0.04	0.20 ± 0.05	0.20 ± 0.04	0.149	0.021
MPV (fL)	8.11 ± 1.34	7.89 ± 1.59	7.98 ± 1.38	0.441	0.005
NEU (106/uL)	5.42 ± 2.19[1]	5.21 ± 1.99[2]	4.06 ± 1.24[1,2]	0.002*	0.077
LYM (103/uL)	2.53 ± 1.05[1]	3.27 ± 1.05[1,2]	2.32 ± 0.45[2]	<0.001*	0.159
MONO (103/uL)	0.53 ± 0.15	0.53 ± 0.29	0.48 ± 0.14	0.296	0.011
BASO (103/uL)	0.07 ± 0.04[1]	0.05 ± 0.05[1]	0.07 ± 0.03	<0.001*	0.040
EOS (103/uL)	0.17 ± 0.14	0.21 ± 0.22	0.18 ± 0.11	0.659	0.015
NEU%	60.93 ± 9.42[1,2]	54.60 ± 10.52[1]	56.64 ± 7.49[2]	0.001*	0.082
LYM%	29.02 ± 7.98[1]	35.70 ± 9.17[1,2]	31.98 ± 5.71[2]	<0.001*	0.118
MONO%	6.34 ± 1.70	5.89 ± 2.48	6.86 ± 2.17	0.061	0.031
BASO%	1.04 ± 0.83[1]	0.60 ± 0.53[1,2]	1.13 ± 0.87[2]	<0.001*	0.089
EOS%	2.04 ± 1.48	2.34 ± 2.06	2.57 ± 1.64	0.277	0.015
NLR	2.47 ± 1.89[1,2]	1.74 ± 0.96[1]	1.80 ± 0.62[2]	<0.001*	0.063
PLR	121.72 ± 55.90[1]	89.11 ± 37.14[1,2]	114.13 ± 46.36[2]	<0.001*	0.088
MLR	0.23 ± 0.08[1]	0.17 ± 0.09[1,2]	0.21 ± 0.07[2]	<0.001*	0.079
BLR	0.03 ± 0.02[1]	0.01 ± 0.01[1,2]	0.03 ± 0.01[2]	<0.001*	0.106
ELR	0.06 ± 0.04	0.06 ± 0.05	0.07 ± 0.04	0.224	0.010

*p<0.05, **p<0.001, Kruskal Wallis Test was used. Degree of Freedom (df, within groups) was 164. Exponential Arabic numerals in "Mean±SD" indicate a significant difference concerning p-value.

A comparison of PD and control groups was shown in Table 2.

ROC analysis was performed based on 104 subjects (63 PD, 41 control). The area under the ROC curve of RDW_CV for PD was 0.682 (p=0.002; 95% CI (0.572-0.791)); neutrophil count for PD was 0.697 (p=0.001; 95% CI (0.598-0.797)). The optimal cut-off score for RDW_CV was 11.12, and its sensitivity and specificity for the diagnosis of PD were 71.4% and 78.0%, respectively. The optimal cut-off score for the neutrophil count was 5.90, and its sensitivity and specificity for the diagnosis of PD were 36.5% and 97.6%, respectively (Figure 1).

ROC analysis was performed based on 102 subjects (61 PA, 41 control). The area under the ROC curve of PLR for PA was 0.714 (p<0.000; 95% CI (0.612-0.815)); BLR for PA was 0.713 (p<0.000; 95% CI (0.611-0.814)); BASO% for PA was 0.718 (p<0.000; 95% CI (0.615-0.822)); lymphocyte count for PA was 0.805 (p<0.000; 95% CI (0.722-0.889)). The optimal cut-off score for PLR was 107.35, and its sensitivity and specificity for the diagnosis of PA were 65.9% and 75.4%, respectively. The optimal cut-off score for BLR was 0.0337, and its sensitivity and specificity for the diagnosis of PA were 51.2% and 83.6%, respectively. The optimal cut-off score for BASO% was 1.2550, and its sensitivity and specificity for the diagnosis of PA were 41.5% and 86.9%, respectively. The optimal cut-off score for lymphocyte count was 0.4307, and its sensitivity and specificity for the diagnosis of PA were 53.7% and 86.9%, respectively (Figure 1).

According to the binary logistic regression analysis, the sensitivity of RDW_CV plus neutrophil count related to the diagnosis of PD was 53.7 percent and the specificity was 79.4 percent (Nagelkerke R2=0.282; -2 Log Likelihood (a): 115.199; [for RDW_CV, p=0.008, Exp(B) 0.504, 95% CI for EXP(B) 0.303-0.838] [for neutrophil count, p=0.001, Exp(B) 0.581, 95% CI for EXP(B) 0.421-0.801].

According to the binary logistic regression analysis, the sensitivity of lymphocyte count related to the diagnosis of PA was 65.9 percent and the specificity was 77.0 percent (Nagelkerke R2=0.363; -2 Log-Likelihood (a): 105.538; p<0.001, Exp(B) 0.163, 95% CI for EXP(B) 0.070-0.378).

Spearman's correlation test results were given in Table 3. There was only significant in the values expressed in Table 3; other correlations were not significant.

Table 2. Comparison of CBC Parameters of PD and Control Groups

Parameters	PD (n=63) Mean ± SD	Control (n=41) Mean ± SD	Cohen's d	Glass's delta	Hedges' g	p
WBC (103/uL)	8.82 ± 2.58	7.24 ± 1.31	0.77	0.61	0.72	<0.001**
RBC (106/uL)	5.39 ± 0.52	5.43 ± 0.91	0.05	0.07	0.05	0.216
HGB (g/dL)	14.12 ± 2.13	13.81 ± 2.31	0.13	0.14	0.14	0.556
HTC (%)	43.91 ± 6.38	44.75 ± 6.15	0.13	0.13	0.13	0.417
MCV (fL)	81.99 ±6.63	80.95 ± 6.22	0.16	0.15	0.16	0.378
MCH (pg)	25.85 ± 3.10	24.70 ± 3.43	0.35	0.37	0.35	0.082
MCHC (g/dL)	31.38 ± 2.08	30.47 ± 2.32	0.41	0.43	0.41	0.056
RDW_CV (%)	11.84 ± 1.69	11.07 ± 0.82	0.57	0.45	0.54	0.002*
PLT (103/uL)	272.56 ± 73.94	255.95 ± 78.08	0.21	0.22	0.21	0.120
PDW (fL)	19.80 ± 1.27	19.74 ± 1.13	0.04	0.04	0.04	0.855
PCT (%)	0.21 ± 0.04	0.20 ± 0.04	0.25	0.25	0.25	0.048*
MPV (fL)	8.11 ± 1.34	7.98 ± 1.38	0.09	0.09	0.09	0.545
NEU (106/uL)	5.42 ± 2.19	4.06 ± 1.24	0.76	0.62	0.72	0.001*
LYM (103/uL)	2.53 ± 1.05	2.32 ± 0.45	0.25	0.20	0.24	0.547
MONO (103/uL)	0.53 ± 0.15	0.48 ± 0.14	0.34	0.33	0.34	0.113
BASO (103/uL)	0.0790 ±0.0419	0.0716 ± 0.0394	0.18	0.17	0.18	0.167
EOS (103/uL)	0.17 ± 0.14	0.18 ± 0.11	0.07	0.07	0.07	0.517
NEU%	60.93 ± 9.42	56.64 ± 7.49	0.50	0.45	0.49	0.015*
LYM%	29.02 ± 7.98	31.98 ± 5.71	0.42	0.37	0.41	0.028*
MONO%	6.34 ± 1.70	6.86 ± 2.17	0.26	0.30	0.27	0.374
BASO%	1.04 ± 0.83	1.13 ± 0.87	0.10	0.10	0.10	0.345
EOS%	2.04 ±1.48	2.57 ±1.64	0.33	0.35	0.34	0.134
NLR	2.47 ± 1.89	1.80 ± 0.62	0.47	0.35	0.43	0.008*
PLR	121.72 ± 55.90	114.13 ± 46.36	0.14	0.13	0.14	0.367
MLR	0.23 ± 0.08	0.21 ± 0.07	0.26	0.25	0.26	0.530
BLR	0.0353 ± 0.0264	0.0317 ± 0.0165	0.16	0.13	0.15	0.834
ELR	0.0674 ±0.0463	0.0776 ± 0.0466	0.21	0.22	0.21	0.265

*p<0.05, **p<0.001, Mann-Whitney U Test was used.

Table 3. The Correlation Between Age and CBC Parameters of Three Groups

Parameters	PD (n=63) (r, p)	PA (n=61) (r, p)	Control (n=41) (r, p)
MCH	-0.142, 0.267	-0.009, 0.945	-0.362, 0.020*
RBC	-0.197, 0.123	-0.121, 0.351	0.532, <0.001**
BASO%	0.094, 0.462	-0.033, 0.803	-0.336, 0.032*
LYM	0.021, 0.871	0.381, 0.002**	-0.142, 0.377
EOS	-0.088, 0.494	0.319, 0.012*	0.041, 0.797
BASO	0.125, 0.329	0.023, 0.860	-0.496, 0.001**

*p<0.05, **p<0.001, Spearmen's Correlation Test was used.

Table 4. The Studies of CBC Parameters in PD

Studies	Diagnosis	RDW_CV	MPV	PDW	HGB	PLT	WBC	RBC	MCHC	PCT	MCV	L	M	E	B	N
This study (for PD, 38 females, 25 males)	DSM-5	↑	↔	↔	↔	↔	↑	↔	↔	↑	↔	↔	↔	↔	↔	↑
Gurok et al.12 (The year 2019; 25 females, 15 males)	DSM-IV-TR				↔	↔	↔	↔	↔		↔	↓	↔	↑	↑	↔
Asoglu et al.16 (The year 2016; 16 females, 14 males)	DSM-5	↑	↑			↔	↑									
Ransing et al.13 (The year 2017; 81 females, 52 males)	DSM-IV	↑	↓	↑	↔	↑	↔	↑	↓	↔	↔					
Hamzekolaei et al.17 (Year 2020; 31 females, 29 males)		↑	↓	↑		↓	↔	↓	↓		↔					
Gunduz et al.19 (Year 2018; 20 females, 19 males)	DSM-5	↔			↔	↔	↔				↔	↑				↔
Gökcegoz Gul et al.14 (Year 2014; 21 females, 16 males)	DSM-IV-TR	↔	↓	↔	↔	↔	↔									
Ransing et al.18 (The year 2020; 68 females, 30 males)	DSM-5	↑	↓	↑	↔	↑		↑	↓	↔	↔					
Kokacya et al.15 (Year 2015; 32 females, 29 males)	DSM-IV-TR		↑		↔	↔			↔							

↑: Significant increase compared to the control group; ↓: Significant decrease compared to the control group; ↔: No significant difference compared to the control

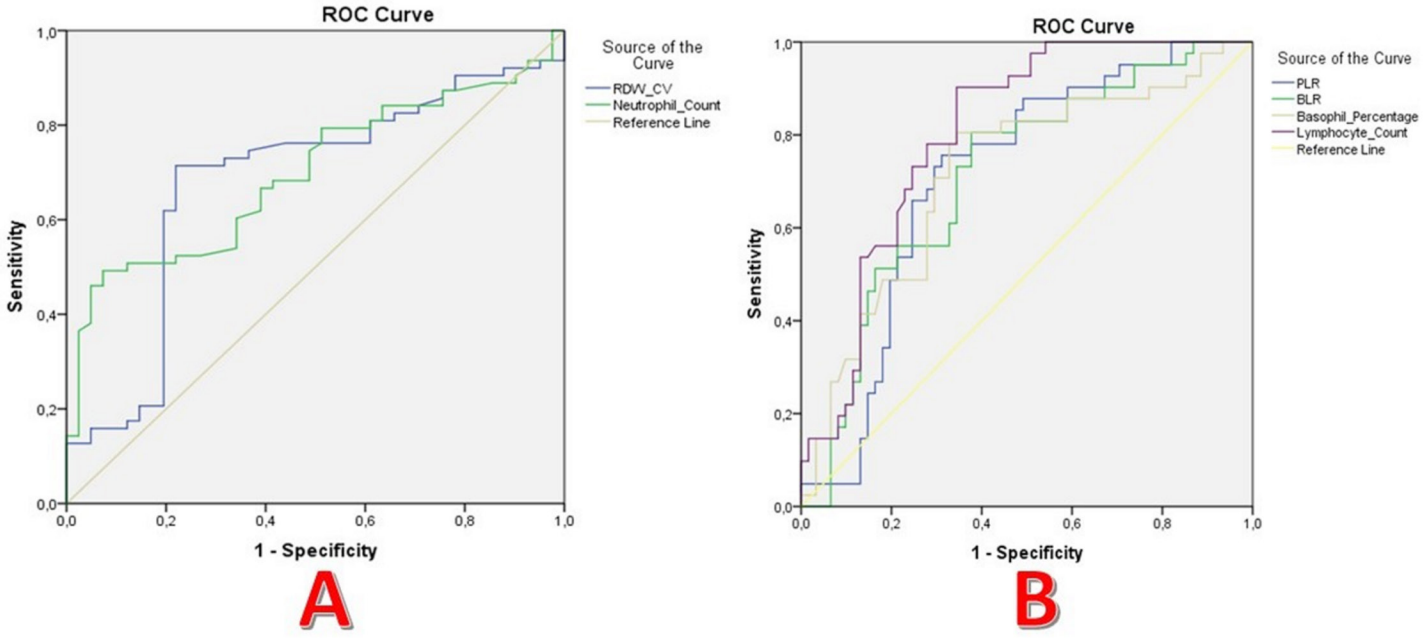

Figure 1. ROC Analysis Findings of PA and PD Groups in Terms of Some CBC Parameters A: PD and Healthy Control; B: PA and Healthy Control

Discussion

Our study suggests that the CBC parameters of PA and PD are demonstrated differently. PA is somewhere between PD and control in terms of RDW_CV, MCH, MCV, MCHC, and PDW values. Significant lowness of MLR, PLR, BLR in PA is associated with LYM increase. A remarkable low basophil was detected in PA. PD was characterized by the neutrophil increase. The reflection of the change in the count of immune cells to the percentages is different and should be taken into consideration when interpreting. Lymphocyte-related ratios were lower in the PA group compared to other groups due to increased LYM. Neutrophil was thought to be an important marker of specificity for the PD group. Lymphocyte parameters and lymphocyte-related ratios were also found to be highly specific for the PA group. Especially the relationship between lymphocyte count and the PA group and neutrophil count and PD group was evident (Figure 1).

The significance levels of the groups' NEU and BASO values and the ordering of the groups' NEU and BASO values were different than the significance level and order of the percentages of the same cells. This condition demonstrated the importance of investigating the immune cell percentage as well as the immune cell count in CBC studies. Gunduz et al. [19] reported that NLR and PLR were similar between PD and control groups. However, in our study, NLR was found to be significantly higher in the PD group than the control group, and the PLR value was similar among the groups.

Table 4 reveals the studies investigating the CBC parameters in PD. RDW_CV has been frequently investigated in PD and has been reported to be mostly elevated. Two studies reported that RDW_CV did not differ significantly between PD and control groups [14,19]. In our study, RDW_CV was found to be elevated in the PD group compared to both PA and control groups. Again, there was no significant difference between PA and control groups in terms of RDW_CV values. This finding suggested that the change in RDW_CV may be more related to the chronicity, not the acute condition. NEU and LYM have only been studied in two types of research [12,19], and their findings were inconsistent (Table 4). In our study, LYM and LYM% increase was associated with PA, and NEU and NEU% increase was associated with PD. While the NEU of PD and PA were similar, the control group's NEU was significantly lower than the patient groups. On the other hand, NEU% of PA and control groups were similar, while NEU% of PD was significantly higher than the PA and control groups. The RDW_CV and LYM findings of Gunduz et al. [19] suggested that the included patient blood results may be from any attack or immediately thereafter. Again, Gunduz et al. [19]'s study reported that NEU did not change significantly in PD. In our study, NEU was high in PD. In PA, NEU% was similar to the control group. This strengthened the possibility that patients included in the study of Gunduz et al. [19] may be PD patients during an acute attack. It is difficult to interpret since Gunduz et al. [19] does not provide information about the period during which the blood samples were taken. Gogcegoz et al. [14] reported that RDW_CV did not reveal a significant difference, while MPV decreased significantly. In our study, MPV was not significant but was lower in PA than PD and control groups (Table 1). These findings suggested the possibility that the blood results included in the study belong to the attack period.

It has been reported that CBC is associated with attack characteristics in psychiatric disorders. It is known that acute or chronic conditions affect CBC differently. Kalelioglu et al. [5] reported that manic and euthymic patients with bipolar disorder showed an increase in NLR and PLR compared to controls. Yildiz et al. [6] reported that NLR is higher in manic and euthymic patients, while depressive patients did not differ from controls in terms of NLR. Giynas-Ayhan et al. [3] stated that NLR was found to be significantly higher in manic, euthymic, and depressed patients with bipolar disorder compared to the control group. Ozdin and Boke [4] reported that NLR, PLR, and MLR values were significantly increased in the relapse period when compared with the remission period of the same patients with schizophrenia. It is suggested that the findings of their study [4] support the inflammation hypothesis of schizophrenia and there is a decrease in the inflammatory response in schizophrenia following treatment.

PA is an important component of PD, but it has an acute feature [2]. Considering that the effects of acute and chronic conditions on CBC can be different, the importance of comparing the CBC values of PD and PA becomes more important. Previous studies have compared CBC parameters between PD patients and control groups [12-19]. Our study is the first of its kind in the literature to compare the CBC values of PA and PD. Also, in our study, the immune cell percentages, MLR, ELR, and BLR of PD were compared for the first time with PA and the control group. The findings of our study support our hypothesis. Table 4 presents all the studies examining the relationship between PD and CBC in a single table. Through this table, it was aimed to compare all the studies in the literature, including the findings of our study.

Despite our significant findings, we have several limitations. The study's retrospective nature was an important limitation. There is a need for studies in which sociodemographic data, psychometric scales, and various inflammatory markers are handled together. Also, it is necessary to compare both attack and non-attack periods of PD in terms of CBC.

As a result, lymphocyte parameters were significantly higher in the PA group. Accordingly, lymphocyte-related ratios were found to be low in PA. Low basophil parameter was suggested to be significantly associated with PA, while neutrophil-related parameters were significantly elevated in PD. The numbers and percentages of the same cells were found to vary between the groups. Further studies can address PD longitudinally and elucidate CBC findings of PA and non-PA. This may also show us the difference between PA in PD and PA without PD.

Conflict of interests
The authors declare that they have no competing interests.

Financial Disclosure
All authors declare no financial support.

Ethical approval
Local ethics committee approval was obtained, and all study participants provided written informed consent (2020/3-23).

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