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Clinical Value of Platelet-Related Parameters and Monocyte Counts in Patients with Oculomotor Myasthenia Gravis

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Abstract

Background: Our study aimed to investigate the clinical value of platelet parameters and the number of Monocytes (MONO) in the peripheral blood of patients with Ocular Myasthenia Gravis (OMG). **Methods:** Fifty patients discharged from the Department of Neurology of the First People's Hospital of Jingzhou City with the diagnosis of OMG from January 1, 2020, to December 31, 2023, were selected as the experimental group, and healthy medical examiners were selected as the control group during the same period. The differences in peripheral blood mononuclear cell count and platelet-related parameters between the two groups were compared. ROC curves were drawn to analyze the clinical value of the studied indexes in patients with OMG. **Results:** Patients with OMG had significantly higher monocyte counts and narrower platelet distributions compared with normal adults; further logistic regression analysis revealed that higher monocyte counts and narrower Platelet Distribution Width (PDW) may be independent influences on the occurrence of OMG ($p < 0.05$), and study with ROC curves suggested that monocyte counts and PDW may have some diagnostic value in the development of OMG may have some diagnostic value. **Conclusion:** Peripheral blood mononuclear cell count and PDW have some diagnostic value in OMG.

Keywords

Ocular Myasthenia Gravis, Mononuclear Cell, Platelet Distribution Width

1. Introduction

Myasthenia gravis (MG) is a rare disease, an autoimmune disorder with impaired

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conduction at the Neuromuscular Junction (NMJ). Clinical manifestations are mainly susceptibility to weakness and fatigue in skeletal and extraocular muscles [1]. Its main causative antibodies are anti-acetylcholine receptor (AChR) antibodies, muscle-specific receptor tyrosine kinase (MUSK) antibodies, and low-density lipoprotein-associated protein 4 (LRP4) antibodies [2]. In 2020, the incidence of MG was first published in China as about 0.68/100,000, and the incidence rate was 0.76/100,000 in females, which is higher than that in males at 0.60/100,000 [3]. Inflammation is thought to play an important role in the development of MG [4], and among the many subtypes of MG, neuromuscular myopathy myasthenia gravis (OMG) accounts for a certain percentage of MG patients. However, due to the complexity of its pathophysiologic mechanisms and the diversity of its clinical manifestations, the diagnosis of OMG still faces many challenges. Monocyte and platelet (PLT) counts, as relevant indicators of inflammation, are closely associated with the development of many autoimmune diseases, but the relationship with OMG has not been studied. In this study, by exploring the correlation between monocyte count, PLT-related parameters, and OMG, we expect to provide valuable diagnostic reference laboratory indicators for further studies of OMG.

2. Information and Methods

2.1. Data Study

Fifty cases of patients discharged from the Department of Neurology of the First People's Hospital of Jingzhou City with a diagnosis of oculomotor myasthenia gravis from January 1, 2020, to December 31, 2023, were selected as the experimental group, of which 29 were male, and 21 were female. In the same period, 50 cases of normal physical examination were selected as the control group.

Inclusion criteria: 1) age greater than 18 years old Chinese; 2) meet the diagnosis of myasthenia gravis, MG diagnostic criteria refer to the "Chinese Guidelines for the Diagnosis and Treatment of Myasthenia Gravis (2020) Edition", *i.e.*, according to the patient's typical clinical symptoms (fluctuating myasthenia gravis), and at the same time comply with any one of the results of the pharmacology (neostigmine test, etc.), fatigue experiments, neurophysiological examination, and antibody test, and exclude other diseases (e.g., hyperthyroidism, blepharospasm, Miller-Fisher syndrome, etc.), confirmed diagnosis of myasthenia gravis; 3) complete clinical data; 4) the Ethics Committee of the hospital approved the study.

Exclusion criteria: 1) age less than 18 years old; 2) patients with severe heart, liver, kidney diseases, other autoimmune diseases, history of persistent infections, tumors, or blood diseases; 3) missing information; 4) receiving immunosuppressive therapy within 3 months.

2.2. Sample Data Collection

Collect general information about all study subjects: age, gender, hospitalization

days, medication, clinical manifestations, underlying diseases, etc.

2.3. Observation Indexes

Statistics of the 1st blood routine results of the study subjects after hospitalization, recording the monocyte count and platelet-related parameters of the experimental and control groups, and statistical analysis.

2.4. Statistical Methods

Based on the nature of the study and the expected differences in key observables between the two groups, we assumed a medium effect size (Cohen's d = 0.5) based on previous research and clinical experience in the field. At the same time, we set a significance level (α) of 0.05 and a desired statistical validity ($1 - \beta$) of 0.80, which is often used in medical research to detect meaningful differences. Calculations were performed using the statistical software SPSS 29.0, which indicated that a total sample size of 100 cases (50 cases per group) would be sufficient to achieve the desired potency. SPSS 29.0 statistical software was used to analyze the data. Count data were expressed as percentages, and a t-test or ANOVA was used for comparison of data between groups; measurement data were expressed as mean plus or minus standard deviation ($x \pm s$), and independent samples t-test was used for conforming to normal distribution, and rank sum test was used for not conforming to normal distribution for between-group comparisons. Logistic regression analysis was used to analyze the influencing factors. The diagnostic value was calculated using the receiver operator characteristic curve (ROC). Statistical differences were considered at $p < 0.05$.

3. Results

3.1. Comparison of Age and Gender (Table 1)

The present study included 100 enrolled cases, 50 cases in the MG group, including 29 males and 21 females, with an average age of 55.94 ± 13.24 years, and 50 cases in the health checkup group, including 29 males and 21 females, with an average age of (56.88 ± 14.46) years. There was no statistically significant difference in the comparison between the basic data ($p > 0.05$).

Table 1. Comparison of basic information between the experimental group and the healthy control group.

Items		Experimental group (n = 50)	Control group (n = 50)	p-value
Age (years)		55.94 ± 13.24	56.88 ± 14.46	0.538
Gender	Male	29 (58%)	29 (58%)	0.580
	Female	21 (42%)	21 (42%)	

Mean age ($p > 0.05$) and gender-matched ($p > 0.05$) were analyzed and found to be statistically non-different between the two groups.

3.2. Comparison of Blood Indices between the Experimental Group and Healthy Control Group (Table 2)

According to the analysis of SPSS 29.0 statistical software, the results of the comparison of the indicators between the experimental group and the control group were as follows: platelet count was 232.44 ± 69.91 than 213.20 ± 35.61, $p < 0.001$, the difference was statistically significant; PDW was 12.82 ± 2.70 than 14.88 ± 0.98, $p < 0.001$, the difference was statistically significant; MONO was 0.44 ± 0.19 versus 0.35 ± 0.81, $p < 0.001$, a statistically significant difference; mean platelet volume was 10.63 ± 1.11 versus 11.34 ± 0.63, $p < 0.001$, a statistically significant difference; and platelet pressure was 0.25 ± 0.07 versus 0.24 ± 0.04, $p < 0.001$, a difference of statistically significant.

Table 2. Comparison of blood indices between the experimental group and the healthy control group.

Indicators	Experimental group (n = 50)	Control group (n=50)	p-value
Platelet count ($\times 10^9$)	232.44 ± 69.91	213.20 ± 35.61	<0.01
Platelet distribution width (%)	12.82 ± 2.70	14.88 ± 0.98	<0.01
Monocyte count ($\times 10^9$)	0.44 ± 0.19	0.35 ± 0.81	<0.01
Mean platelet volume (fl)	10.63 ± 1.11	11.34 ± 0.63	<0.01
Platelet pressure (%)	0.25 ± 0.07	0.24 ± 0.04	<0.01

Note: platelet count, monocyte count, and platelet pressure water in the experimental group were, on average, higher than those in the control group ($p < 0.01$), and platelet distribution width and mean platelet volume in the experimental group were lower than those in the control group (both $p < 0.01$).

3.3. Binary Logistic Regression Analysis (Table 3)

Table 3. Binary logistic regression analysis.

Influencing factors	β	Standard error	Wald	OR	p-value
Platelet count	0.008	0.047	0.027	1.008	0.870
Platelet distribution width	−0.521	0.191	7.416	0.594	0.006
Mean platelet volume	−0.012	0.974	0.000	0.988	0.990
Platelet pressure area	−6.035	42.872	0.020	0.002	0.888
Monocyte count	7.152	2.976	5.777	1277.036	0.016

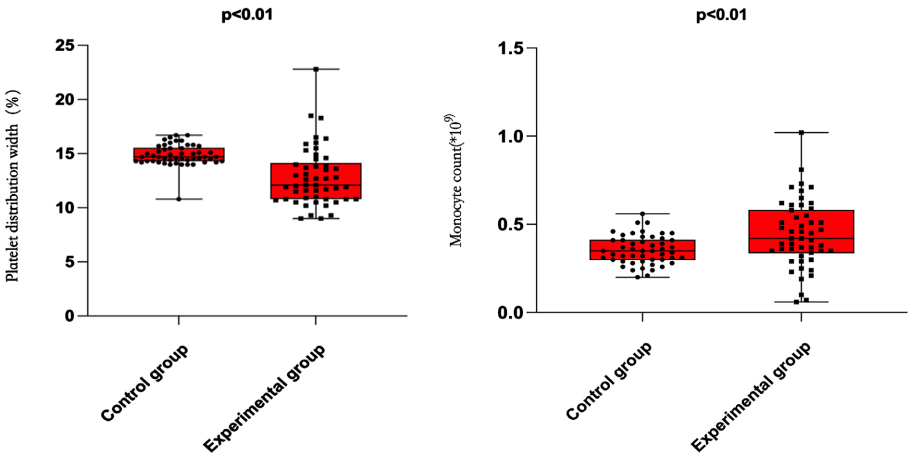
Note: the results showed that the monocyte count of the experimental group was higher than that of the control group, the platelet distribution width was smaller than that of the control group, and the differences were statistically significant ($p < 0.05$).

In the binary logistic regression finding analysis, we found that both PDW and MONO $p < 0.05$, indicating a linear relationship with MG. $\beta = -0.524$, OR = 0.594, $p = 0.006$ for PDW, indicating that for every 1 unit increase in PDW, there was a

40.6% reduction in the risk of MG. β = for MONO, p = 0.016, indicating that for every 1 unit increase in PDW, there was a 1277.036-fold increase in the risk of MG. 7.152, OR = 1277.036, p = 0.016, indicating that for every 1 unit increase in MONO, the risk of developing MG increased by 1277.036 times. Platelet count, mean platelet volume, and platelet pressure area all had p greater than 0.05, indicating no linear relationship with OMG.

3.4. Comparison of Monocyte Count and Platelet Distribution Width between Experimental and Control Groups (Figure 1)

The difference was statistically significant in terms of the monocyte count and platelet distribution width in both the experimental and control groups at p less than 0.05.



Note: platelet distribution width and monocyte count are independent risk factors for ocular myasthenia gravis ($p < 0.05$).

Figure 1. Comparison of platelet distribution width and monocyte count between experimental and control groups.

3.5. Diagnostic Value of Monocyte Count and Platelet Distribution Width for OMG by ROC Curve Analysis (Table 4, Figure 2)

After binary logistic regression analysis, the independent risk factors affecting the occurrence of OMG were MONO and PDW, and the discriminatory ability of the two blood indicators, monocytes and platelet distribution width, for OMG was further analyzed by ROC curve. The results showed that the area under the curve (AUC) of monocytes for predicting the occurrence of OMG was 0.665 (95% CI: 0.555 - 0.775), and the optimal cutoff value of monocyte count for diagnosing) OMG was 0.4450; the sensitivity and specificity were 48% and 90%, respectively, and Jordon's index was 0.360; and the area under the curve (AUC) for predicting the occurrence of OMG was 0.800 (95% CI: 0.800 - 0.775). AUC was 0.800 (95% CI: 0.700 - 0.900), with an optimal cutoff value of 13.950 for the diagnosis of OMG; sensitivity and specificity were 98% and 74%, respectively, and the Jordon index was 0.72.

Table 4. Predictive value of monocyte and platelet distribution width in OMG patients.

Indicators	Cutoff value	Sensitivity (%)	Specificity (%)	Jordon's index	AUC	95% CI
Monocyte count	0.4450	48%	90%	0.36	0.665	0.555 - 0.775
Platelet distribution width	13.950	98	74	0.72	0.800	0.700 - 0.900

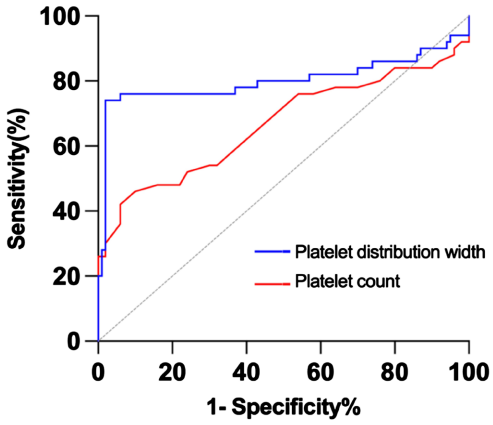


Figure 2. ROC curve analysis.

4. Discussion

MG is a treatable disease; symptoms can be avoided or alleviated by timely diagnosis [5]. MG, as its subtype, is diagnosed by pharmacological examination, electrophysiological examination, serum antibody detection, thymic imaging, comorbidities with other autoimmune disorders, and determination of typical joint clinical features [6]. Most auxiliary examination processes are complicated, so finding simple, convenient, fast, and accurate auxiliary diagnostic methods is essential.

Inflammation is recognized as an important contributor to the pathogenesis of systemic and OMG, occurring in approximately 80% and 50% of MG patients, respectively [7] [8]. Mediators of inflammation are mainly released by inflammatory monocytes and macrophages in the affected postsynaptic NMJ or thymic tissues [4] [9] [10] and then enter the external circulation. Subsequently, AChR-specific T cells infiltrate the NMJ or thymic microenvironment and interact with B cells to induce their autoimmune activation [11]. A study of RNA-seq analysis of peripheral blood mononuclear cells (PBMCs) from AChR-MG patients [12] and nCounter transcriptome analysis of epigenetic repressor regulator genes of histone deacetylase in an experimental mouse model of MG showed [4] [13] a clear dysregulation of inflammatory molecules associated with altered autoantibody levels.

Monocyte subpopulations may be involved in the development of MG, influencing autoimmune responses and inflammation. One study found [12] that monocyte sequencing in MG patients showed that monocytes exhibited more

heterogeneity, while MG patients showed high levels of inflammatory markers. Others have found that all monocyte subpopulations are reduced in MG patients, including classical, intermediate, and atypical monocytes [14]. Dong [15] *et al.* suggested that monocytes play a crucial role in the pathologic process of MG and observed that alterations in the number and function of monocytes in patients with MG might be closely related to the development of MG and that decreasing the antigen-presenting capacity of monocytes to reduce autoimmune disease promotion may be a potential therapeutic target. This study's results verified a correlation between monocytes and the development of MG (**Table 3**, **Table 4**, **Figure 1**).

PLT has been shown to play an important role in inflammatory and immune responses. Platelet Distribution Width (PDW) represents heterogeneity in PLT morphology and is clinically associated with PLT activation [16]. PDW is seldom used as a reference indicator in diagnosing MG, but it serves as one of the PLT parameters that may inform the diagnostic assessment of MG during primary screening.MG is an autoimmune disease that can lead to PLT activation, aggregation, and destruction, thus affecting the volume distribution of PLT. Therefore, abnormalities in PDW may indirectly reflect the state of immunoinflammation in MG patients, which is partially consistent with the results in **Tables 3-4** of this article. However, PDW is susceptible to other factors, and other inflammatory diseases leading to its abnormalities must be excluded when diagnosing MG. According to the results in **Table 4** and **Figure 1**, PDW has high sensitivity but low specificity in MG diagnosis, so it can only be used as an auxiliary indicator for early primary screening to assess the overall condition of the patient and the patient's clinical manifestations, medical history, other testing indicators, and therapeutic response need to be taken into account.

The results of this study showed (**Figure 1**) that the monocyte count of patients in the experimental group was higher than that of the control group and positively correlated with the control group; the PDW was lower than that of the control group and negatively correlated with the control group; suggesting that there is a correlation between the monocyte count and the level of the PDW and the patients with OMG. Logistic regression analysis showed (**Table 4**) that an elevated monocyte count and a decreased level of the PDW were important OMG occurrence Imaging factors. Both monocytes and PDW are involved in the inflammatory response process in this study, it was found by ROC curve analysis (**Figure 2**) that the AUC of monocyte count and PDW for diagnosis of OMG were 0.665 and 0.800, respectively, suggesting that the two indexes have a certain diagnostic value for OMG, which provides a further reference for clinicians to diagnose OMG.

5. Conclusions

Peripheral blood monocyte count and PDW level are closely related to the occurrence of OMG, and both indicators have some value in diagnosing OMG patients.

Study limitations: One of the major limitations of this study was the sample size. Although we determined a sufficient sample size to achieve the required statistical

validity through a potency analysis, the sample sizes of 50 patients with OMG and 50 normal healthy individuals are still relatively small for broad clinical practice. This may lead to some uncertainty in generalizing our findings to larger or broader groups of subjects. Therefore, future studies should consider incorporating larger sample sizes to validate our findings further.

Authors' Contributions

Yaping Sun was responsible for writing the paper, organizing the data and statistics, and reviewing the data; Ke Peng was responsible for literature search and screening; Xianglin Cheng was responsible for reviewing the statistical data, checking and guiding the writing of the paper, and completing the final draft.

Ethics Approval

The study protocol was approved by the Ethics Committee of the First People's Hospital of Jingzhou City (Grant No. YJ202376).

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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