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Evaluation of Platelet Distribution Width(PDW) and Mean Platelet Volume(MPV) in patients with Obstructive Sleep Apnea Syndrome(OSAS): A Retrospective Clinical Study

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ABSTRACT

This study aimed to evaluate the association between PDW and MPV with Obstructive Sleep Apnea Syndrome (OSAS).
The study's design is a retrospective evaluation of OSAS patients admitted to our pulmonology department between January 2022 and June 2024. The data and clinical-laboratory parameters of patients diagnosed with polysomnography were evaluated. The PDW and MPV measurements were retrieved from the complete blood counts' of the patients. OSAS patients were divided into three groups according to the Apnea-hypopnea Index(AHI) score as mild, moderate and severe OSAS. Healthy subjects with no known chronic disease admitted to our outpatient clinic were enrolled as control group.
In total, 140 patients with OSAS and 120 healthy subjects as control group were included in the study. The OSAS groups consisted of as 60 mild, 45 moderate, and 35 severe. The mean age of OSAS group and control group were as 51.8±12 and 47.6±11, respectively which was not statistically significant. There was statistically significant difference between OSAS and control group with respect to the BMI(31.8±5.0 vs 26.4±4.2, p:0.01). The male/female patients were 96/44 in OSAS and 86/34 in control group which was not statistically different (p:0.04). The mean PDW and MPW were 18.8±2.5 and 10.7±1.2 in OSAS group. The mean PDW and MPV were 14.6±1.7 and 7.8±2.4 in control group. There was statistically significant difference between OSAS and control group with respect to mean PDW and MPV values (p:0.02 and p:0.01). The subgroup analysis showed that MPV increased statistically significant as OSAS severity got impaired.
This study showed that increased PDW and MPV was associated with OSAS and also the activation of platelets has potential effect on the severity of OSAS.

Keywords: Obstructive Sleep Apnea Syndrome, Mean Platelet Volume, Platelet Distribution Width, Hypoxia, Sleep.

Introduction

Obstructive Sleep Apnea Syndrome (OSAS) is a prevalent disease specified by repeated episodes of partial or total obstruction of the upper airway during sleep, leading to intermittent hypoxia, sleep interruption, and different adverse cardiovascular and metabolic results. The syndrome is linked with elevated morbidity and mortality rates, basicly due to its strong linkage with cardiovascular disorders, hypertension, and metabolic consequences (1).

Platelets have a vital function in hemostasis and thrombosis, and their role and morphology can be changed in different pathological conditions. Two important platelet markers, Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW), have gained attention as potential biomarkers for cardiovascular risk stratification and oxidative status of various conditions. MPV is a measure of the approximated volume of platelets in the blood and is considered an indicator of platelet activation. PDW shows the variability in platelet size and is an indicator of platelet anisocytosis. Both indices are readily available from routine complete blood counts and have been accused in the pathogenesis of thromboembolic events (2).

Increased evidence recommends that cases with OSAS show elevated levels of platelet activation and aggregation, which may have role to the increased cardiovascular risk found in this population (3, 4). However, the relationship between OSAS and changes in platelet indices such as MPV and PDW remains incompletely understood. This retrospective

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clinical study aims to evaluate the levels of MPV and PDW in patients with OSAS compared to healthy controls, and to explore the potential role of these indices as biomarkers for severity in OSAS patients.

By elucidating the relationship between OSAS and platelet indices, this study aims to enhance our understanding of the pathophysiological mechanisms underlying the increased cardiovascular risk in OSAS due to the activation of hypoxia-induced thrombosis and to identify potential biomarkers that could aid in the severity stratification and management of patients with this disorder.

Materıal and Methods

The patients who were admitted to our outpatient pulmonology department with complaints of sleep-disordered breathing were retrospectively evaluated. Patients were consulted with our sleep laboratory and all patients had an overnight polysomnographic sleep study. The patients were diagnosed with OSAS according to the apnea/hypopnea index (AHI). 120 patients with AHI score < 5 as control group and 140 with AHI score>5 and with complaints were accepted as OSAS. The OSAS group were divided into three group according to the AHI score and severity of the disease as: Mild (AHI:5-15), moderate (AHI:15-30) and severe (AHI>30).

The study followed the guidelines of Helsinki Decleration of Human Rights and was approved by the ethical committee of Van Yuzuncu Yil University which approved the study and gave ethical acceptance with 2024/09-14 number at the date of 09.08.2024. All patients gave informed consent for the use of their clinical data in the study before Polysomnography tests.

The exclusion criterias were as: Patients with any known chronic disease including liver and kidney, any patients with hematologic diseases, any patients with chronic heart diseases, any patients with systemic inflammatory diseases and patients with malignancies.

Polysomnography: Using a 16-channel Embla (Medcare Inc., Iceland) persistent sleep specialist assistant checking, overnight polysomnography was carried out. The device has two EOG channels, submental EMG, oronasal air flow, thoracic and abdominal motions, pulse oximeter oxygen saturation, tibial EMG, body position finder, EKG, and tracheal sound in addition to four EEG channels (with electrode ports at C4-A1, C3-A2, O2-A1, and O1-A2) and two EOG channels. The complete halting of airflow for longer than ten seconds was defined as apnea. A >30% reduction in airflow that lasted longer than 10 seconds together with >4% desaturation and/or arousal was considered hypopnea. AHI was defined as the typical number of apnea and hypopnea episodes per hour of sleep. The assumption behind the OSAS conclusion was an apnea/hypopnea index (AHI) greater than five sleep phases.

The patients data records were retrieved from hospital database including demographic variables like age, sex, body mas index and anamnesis. Also, the laboratory data including complete blood counts which shows PDW-MPV and polysomnography results were obtained from medical records.

Statistical Analysis: The mean, standard deviation, minimum value, and maximum value are the expressions used in descriptive statistics for continuous variables. Numbers and percentages are used to express categorical variables. The means of continuous variables were compared between groups using One-Way Variance Analysis (ANOVA). Student-t test and chi-square test were used for categorical variables. For all statistical data, $p < 0.05$ was considered significant. IBM-SPSS 22.0 version statistical software program for Windows (IBM Corporation, Armonk, NY, USA) was used for statistical evaluation.

Results

This study included 140 patients with OSAS and 120 healthy subjects as control group. The OSAS patients were divided into three categories according to AHI sccore and 60 cases with mild OSAS, 45 cases with moderate OSAS and 35 cases with severe OSAS were identified from medical records. Some demographic characteristics are shown in Table 1 and age, sex, smoking status and chronic disease including hypertension and diabetes were not statistically different between two groups. The mean age of OSAS group and control group were as 51.8±12 and 47.6±11 years, respectively (p:0.112). Body mass index in OSAS group was statistically significantly higher than control group (31.8±5.0 vs 26.4±4.2, p:0.01). The mean AHI in OSAS and control group were found to be statistically significantly different as 32.1±25.4 vs 2.42±1.56, respectively (p:0.001). The minimum O2 saturation in OSAS group was 73.4±10.8 and in control group was 94.2±1.6 which was statistically different(p:0.001).

Table 2 shows the comparison of hematologic results of the OSAS and control groups. The average number of Hb, Htc, WBC and platelets were not

Table 1: Demographic and Clinical Characteristics of OSAS and Control Groups

	Control group (n:120)	OSAS group (n:140)	P value
Age, years(mean±SD)	47.6□ 11	51.8□ 12	0.112
BMI, (kg/m2)	26.4□ 4.2	31.8□ 5.0	0.01
AHI	2.42□ 1.56	32.1□ 25.4	0.001
Sex			
Male, n(/%)	86(72%)	96(68%)	0.04
Female, n(%)	34(28%)	44(32%)	
Smoking			
Yes, n(%)	42(35%)	56(40%)	0.06
No, n(%)	78(65%)	84(60%)	
Mean O2 saturation	98.2□ 1.4	84.2□ 11.5	0.001
Minimum O2 saturation	94.2□ 1.6	73.4□ 10.8	0.001
Diabetes mellitus			
Yes, n(%)	14(11%)	19(13%)	0.627
No, n(%)	106(89%)	121(87%)	
Hypertension			
Yes, n(%)	28(23%)	33(23%)	0.542
No, n(%)	92(77%)	107(77%)	

OSAS: Obstructive Sleep Apnea Syndrome, AHI: apnea/hypopnea index, O2:Oxygen, SD: standard deviation, P<0.05 indicates statistical significance

Table 2: Comparison of Hematologic Results of the OSAS and Control Group

	Control group (n:120)	OSAS group (n:140)	P value
Hb, g/l (mean □ sd)	13.4□ 2.2	14.1□ 2.6	0.324
Hematocrit (mean □ sd)	38.9□ 7.6	42.6□ 4.2	0.16
WBC count, /µl (mean □ sd)	8.9□ 4.2	10.6□ 2.4	0.24
MPV, fl (mean □ sd)	7.8□ 2.4	10.7□ 1.2	0.002
PDW, fl (mean □ sd)	14.6□ 1.7	18.8□ 2.5	0.001
Platelets, ×103/µl (mean □ sd)	180.6□ 34.2	220.45□ 56.4	0.632

OSAS: Obstructive Sleep Apnea Syndrome, WBC: White Blood Cell, MPV: Mean Platelet Volume, PDW: Platelet Distribution Width, Hb:Hemoglobin, P<0.05 indicates statistical significance

significantly different between OSAS and control groups. The mean platelet volume measurements(MPV) were found to be statistically significantly higher in OSAS group than healthy control group (10.7±1.2 vs 7.8±2.4, P value:0.002). And also, the mean of PDW measurements were found to be statistically significantly higher in OSAS group than healthy control group (18.8±2.5 vs 14.6±1.7, P value:0.001).

The subgroup analysis of OSAS patients is shown in Table 3. The PDW levels didnot show any statistical significant difference among the three subgroups of OSAS. However, the MPV level was found to be statistically higher in severe OSAS group than the mild and moderate OSAS(P=0.02). This means that the increased level of MPV in OSAS patients may have a potential association with the severity of the disease.

Table 3: MPW and PDW Measurements in OSAS Subgroups

	Mild OSAS (n:60)	Moderate OSAS (n:45)	Severe OSAS (n:35)	P value
MPV, fl (mean sd)	8.9 1.2	9.6 2.1	10.7 2.3	0.02
PDW, fl (mean sd)	15.2 2.6	16.1 2.8	18.8 2.2	0.57

MPV: Mean Platelet Volume, PDW: Platelet Distribution Width, P<0.05 indicates statistical significance

Dıscussıon

In this retrospective clinical study, we investigated the link between platelet markers, specifically Platelet Distribution Width (PDW) and Mean Platelet Volume (MPV), and Obstructive Sleep Apnea Syndrome (OSAS). Our results show that cases with OSAS exhibit significantly higher PDW and MPV values compared to healthy controls. Furthermore, a positive correlation was found between the severity of OSAS and MPV levels.

The association between increased platelet activation and OSAS development has been studied in the literature(5) However ,this mechanism has been elucidated comprehensively yet. OSAS is characterized by intermittent hypoxia, which has been shown to enhance platelet activation and aggregation. The thrombosis and platelet activation that lead to the changes in thrombocyte volüme and distribution are attributed to this hypoxic status of OSAS (6). Hypoxia-inducible factors and oxidative stress play crucial roles in this process, contributing to an elevated cardiovascular risk in OSAS patients. Increased MPV and PDW, as indicators of platelet activation and anisocytosis, respectively, may reflect an underlying pro-thrombotic state in these patients.

Our study's findings are consistent with previous researches showing that platelet activation indices are elevated in OSAS. For instance, Erden et al. demonstrated elevated MPV levels in patients with OSAS, suggesting enhanced platelet activation and aggregation(7). Similarly, our findings show that MPV levels are significantly higher in severe OSAS compared to mild and moderate cases, highlighting the potential role of MPV as a biomarker for disease severity.

Although PDW levels were significantly increased in the OSAS group compared to controls, no significant difference was found among the OSAS subgroups. This finding might be due to the complexity of PDW as a marker, which reflects both platelet activation and the level of anisocytosis (8). Further studies are needed to elucidate the specific role of PDW in OSAS and its potential as a prognostic marker.

The higher body mass index (BMI) observed in the OSAS group compared to the control group may also has role in the increased platelet markers. Obesity is a known risk factor for both OSAS and increased platelet activation, and its interplay with OSAS warrants further investigation (9, 10). Nevertheless, our study controlled for other confounding factors such as chronic diseases, ensuring that the observed differences in platelet indices are primarily attributable to OSAS.

Some limitations regarding this study should be mentioned. The retrospective design may introduce selection bias, and the relatively small sample size limits the generalizability of the results. In addition, any confounding variables on the platelet activation and aggregation which have effect on the PDW and MPV measurements limits the acceptibility and reproducibility of this study.

In conclusion, this study demonstrates a significant association between increased PDW and MPV with OSAS, suggesting that platelet activation plays a role in the pathophysiology of the syndrome. MPV, in particular, shows potential as a biomarker for OSAS severity. These findings contribute to the understanding of the mechanisms underlying the increased cardiovascular risk in OSAS patients and highlight the need for further research to explore the clinical utility of platelet indices in the management of OSAS.

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References

1. Caples, S.M.; Gami, A.S.; Somers, V.K. Obstructive Sleep Apnea. Ann. Intern. Med. **2005**, 142, 187–197.
2. Nording, H.M.; Seizer, P.; Langer, H.F. Platelets in Inflammation and Atherogenesis. Front. Immunol. **2015**, 6, 98.
3. Archontogeorgis K, Voulgaris A, Papanas N, et al. Mean Platelet Volume and Platelet Distribution Width in Patients With Obstructive Sleep Apnea Syndrome and Concurrent Chronic Obstructive Pulmonary Disease. Clin Appl Thromb Hemost. 2018 Nov;24(8):1216-1222.

4. Yamauchi, M.; Kimura, H. Oxidative Stress in Obstructive Sleep Apnea: Putative Pathways to the Cardiovascular Complications. Antioxid. Redox Signal. **2008**, 10, 755–768.
5. Di Lorenzo B, Scala C, Mangoni AA, et al. A Systematic Review and Meta-Analysis of Mean Platelet Volume and Platelet Distribution Width in Patients with Obstructive Sleep Apnoea Syndrome. Biomedicines. 2024 Jan 24;12(2):270.
6. Nording, H.M.; Seizer, P.; Langer, H.F. Platelets in Inflammation and Atherogenesis. Front. Immunol. **2015**, 6, 98.
7. Erden EŞ, Yengil E, Tuncel E, et al. Investigation of the relationship between mean platelet volume and obstructive sleep apnea syndrome. J Clin Exp Invest. 2013;4(4):492-6.
8. Nena E, Papanas N, Steiropoulos P, Et al. Mean Platelet Volume and Platelet Distribution Width in Non-Diabetic Subjects with Obstructive Sleep Apnoea Syndrome: New Indices of Severity? Platelets **2012**, 23, 447–454.
9. Nkambule, B.B.; Mxinwa, V.; Nyambuya, T.M.; Dludla, P.V. The Mean Platelet Volume and Atherosclerotic Cardiovascular-Risk Factors in Adults with Obesity: A Systematic Review and Meta-Analysis of Observational Studies. BMC Nutr. **2022**, 8, 47.
10. Chu, S.G.; Becker, R.C.; Berger, P.B. et al. Mean Platelet Volume as a Predictor of Cardiovascular Risk: A Systematic Review and Meta-Analysis. J. Thromb. Haemost. JTH **2010**, 8, 148–156.