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Can MPV be a Marker for Thyroid Malignancy in Thyroidectomy Patients?

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ABSTRACT

Introduction: Mean platelet volume (MPV) level can be affected by various factors. This study aimed to show the relationship between pre-operative MPV levels and histopathological diagnosis of thyroid malignancy in patients scheduled for surgery due to any thyroid-related disease.

Methods: A total of 263 patients who were diagnosed with thyroid-related disease in various clinics of Private Esencan Hospital, Clinic of General Surgery and decided to undergo thyroidectomy between January 2020-December 2023 were included in the study. Preoperative MPV values of the patients were studied in the biochemistry laboratory on ARCHITECT i1000SR and i2000SR (Abbott Diagnostics, Ireland) devices.

Results: The mean age of the patients was 53.4±18.4 (range: 18-83) years. The mean MPV value was 9.3±1.0 fL (range: 7.1-11.1). The presence of malignancy was detected in the histopathological examination of postoperative biopsies of a total of 111 (42.2%) patients. The mean MPV level in the group with malignancy was found to be significantly higher than in the group without malignancy (9.55 fL vs. 9.16 fL; p=0.001). Mean MPV levels were found to be similar among genders, operation types, presence of thyroiditis and presence of comorbid diseases (p>0.05 for each). In the logistic regression analysis, it was determined that MPV level was an independent risk factor for thyroid malignancy (p=0.001). Accordingly, it was determined that for each unit increase in MPV level, the odds ratio of having a thyroid malignancy in the patient was 1.6 times (1.2-2.1; risk coefficient) higher. In the receiver operating characteristic analysis, the sensitivity and specificity of the 9.45 fL threshold value for MPV in predicting thyroid malignancy were found to be 60.4% and 53.3%, respectively (area under the curve: 0.604; p=0.04; lower bound-upper bound: 0.536-0.672).

Conclusion: The findings obtained in this study, which compared only patients who were decided to have thyroidectomy, which is a rare situation in the literature, show that MPV levels before thyroidectomy in patients with thyroid cancer are significantly higher than in thyroidectomy patients without malignancy. MPV levels in patients who will undergo thyroidectomy can provide valuable information in predicting malignancy.

Keywords: Mean platelet volume, thyroidectomy, thyroid cancer, papillary thyroid cancer

Introduction

Thyroid cancers are tumors that arise from the cells of the thyroid gland. Thyroid cancers account for approximately 1% of all cancers, but are one of the most common endocrine cancers. It has been stated that the incidence of thyroid cancer is increasing worldwide. Among thyroid cancers, papillary, follicular, medullary, and anaplastic thyroid cancers are the most common. Fine needle aspiration biopsy is the gold standard method for diagnosis. The survival time is significantly longer in cases diagnosed early (1-3).

Mean platelet volume (MPV) is an important indicator of platelet functions. MPV is associated with platelet aggregation and activation. It has been shown that there is a relationship between MPV levels and various cancers, cardiovascular events, bleeding diseases, and many autoimmune disorders. For example, it has been reported that platelet volume increases in acute cardiac events, diabetes, and cancer cases. On the contrary, a decrease in MPV has been reported in cases of ulcerative colitis, some gastric tumors, and tuberculosis. MPV level has been shown to be an indicator of mortality and morbidity in many studies (4-7).

It has been shown that MPV level can be affected by thyroid hormone levels (8-11) and changes significantly in thyroid cancers (6,7,12-19). However, while many studies have reported an increase in MPV levels in thyroid cancer cases (6,7,12-17), some studies have reported no change (18,19), and some have even reported MPV decreases in these cases. This study aimed to show the relationship between pre-operative MPV levels and histopathological diagnosis of thyroid malignancy in patients scheduled for surgery due to any thyroid-related disease.

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Methods

A total of 263 patients who were diagnosed with thyroid-related disease in Private Esencan Hospital, Clinic of General Surgery and decided to undergo thyroidectomy between January 2020 and December 2023 were included in the study.

The study was conducted after obtaining approval from the Ethics Committee of the University of Health Sciences Türkiye, İstanbul Training and Research Hospital (approval number: 104, date: 18.10.2024).

Preoperative MPV values of the patients were studied in the biochemistry laboratory on ARCHITECT i1000SR and i2000SR (Abbott Diagnostics, Ireland) devices. The process of collecting, transferring and testing samples was carried out in accordance with the recommendations of the manufacturers. Thyroid tissue material taken during the operation was examined histopathologically in the pathology laboratory.

Patients who were 18 years of age and above and who were scheduled to undergo thyroidectomy primarily due to thyroid disease were included in the study. Patients planned to undergo thyroidectomy due to non-thyroidal reasons, and patients under the age of 18 were excluded from the study.

Statistical Analysis

All statistical analyses in the study were performed using SPSS 25.0 software (IBM SPSS, Chicago, IL, USA). Descriptive data were given as mean and standard deviation, and distributions of nominal or ordinal variables were given as numbers and percentages. Comparisons between groups in terms of categorical variables were made with the chi-square test. The Kolmogorov-Smirnov test was used to analyze whether continuous variables were normally distributed or not. Differences between groups for continuous variables were analyzed by Student's t-test, and comparisons of mean values between multiple groups were analyzed using analysis of variance. The risk coefficients of the variables in terms of thyroid malignancy were determined by logistic regression analysis. The predictive capacity of the 9.45 fL threshold value for MPV for malignancy was analyzed by receiver operating characteristic (ROC) analysis. The results were evaluated within the 95% confidence interval, and p-values <0.05 were considered significant.

Results

The mean age of the patients was 53.4±18.4 (range: 18-83) years. The mean MPV value was 9.3±1.0 fL (range: 7.1-11.1). The presence of malignancy was detected in the histopathological examination of postoperative biopsies of a total of 111 (42.2%) patients. There were signs of thyroiditis in 52 (19.8%) patients in the preoperative ultrasound examination. A total of 132 (50.2%) patients had comorbid diseases (Table 1).

The group with malignancy and the groups without malignancy were similar in terms of gender, presence of preoperative thyroiditis, presence of comorbid disease, distribution of the type of operation performed, and mean age (p>0.05; for each) (Table 1).

The mean MPV level in the group with malignancy was found to be significantly higher than in the group without malignancy (9.55 fL vs. 9.16 fL; p=0.001). Mean MPV levels were found to be similar between genders, operation types, presence of thyroiditis and presence of comorbid diseases (p>0.05; for each) (Table 2).

Table 1. Distributions according to some variables

	Total		No malignancy, (n=152)		Malignancy present, (n=111)		p
	n	%	n	%	n	%	
n	263	100	152	57.8	111	42.2	
Age (mean & SD) (years)	53.4	18.4	55.0	18.8	51.2	17.7	0.096
Gender							
Male	145	55.1	76	50.0	69	62.2	0.050
Female	118	44.9	76	50.0	42	37.8	
Operation type							
Bilateral total thyroidectomy	228	86.7	132	86.8	96	86.5	0.996
Unilateral total thyroidectomy	28	10.6	16	10.5	12	10.8	
Completion thyroidectomy	7	2.7	4	2.6	3	2.7	
Thyroiditis on preoperative USG							
Absent	211	80.2	123	80.9	88	79.3	0.741
Present	52	19.8	29	19.1	23	20.7	
Comorbid disease							
Absent	131	49.8	70	46.1	61	55.0	0.154
Present	132	50.2	82	53.9	50	45.0	

MPV: Mean plathelet volume, SD: Standard deviation, USG: Ultrasonography

Table 2. Comparison of mean MPV levels across different variables

	MPV (fL)		p
	Mean	SD	
Gender			
Male	9.42	0.94	0.071
Female	9.21	0.97	
Malignancy			
None	9.16	1.01	**0.001**
Present	9.55	0.083	
Operation type			
Bilateral total thyroidectomy	9.36	0.98	0.385
Unilateral total thyroidectomy	9.09	0.86	
Completion thyroidectomy	9.28	0.76	
Thyroiditis on preoperative USG			
Absent	9.31	0.98	0.482
Present	9.41	0.88	
Comorbid disease			
Absent	9.35	0.94	0.688
Present	9.30	0.98	

MPV: Mean plathelet volume, SD: Standard deviation, USG: Ultrasonography

In the logistic regression analysis, it was determined that MPV level was an independent risk factor for thyroid malignancy (p=0.001). Accordingly, it was determined that for each unit increase in MPV level, the probability of having a thyroid malignancy in the patient was 1.6 times (odds ratio: 1.2-2.1) higher. It was determined that sex, operation type, presence of thyroiditis on preoperative ultrasound, and comorbid disease were not independent risk factors for the presence of malignancy (p>0.05 for each) (Table 3).

In the ROC analysis, the sensitivity and specificity of the 9.45 fL threshold value for MPV in predicting thyroid malignancy were found to be 60.4% and 53.3%, respectively (area under the curve: 0.604; p=0.04; lower bound-upper bound: 0.536-0.672) (Figure 1).

Table 3. Logistic regression analyzes performed for the presence of thyroid malignancy

	p	Exp(B) (OR)	95% CI lower-upper
MPV	0.001	1.6	1.2-2.1
Gender			
Male			
Female	0.051	0.6	0.4-1.0
Operation type			
Bilateral total thyroidectomy			
Unilateral total thyroidectomy	0.939	1.0	0.5-2.3
Completion thyroidectomy	0.968	1.0	0.2-4.7
Thyroiditis			
Absent			
Present	0.741	1.1	0.6-2.0
Comorbid disease			
Absent			
Present	0.154	0.7	0.4-1.1

MPV: Mean plathelet volume, OR: Odds ratio, CI: Confidence interval

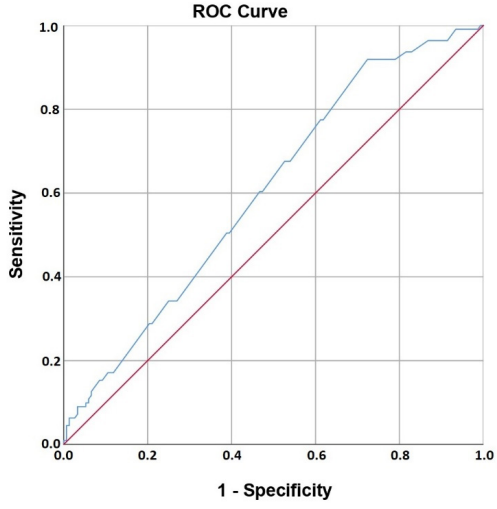

Figure 1. In the ROC analysis, the sensitivity and specificity of the 9.45 fL threshold value for MPV in predicting thyroid malignancy were found to be 60.4% and 53.3%, respectively (AUC: 0.604; p=0.04; LB-UB: 0.536-0.672) ROC: Receiver operating characteristic, MPV: Mean plathelet volume, AUC: Area under the curve, LB-UB: Lower bound-upper bound

Discussion

Platelet volume varies depending on platelet activation, platelet production, and the destruction resulting from many conditions in the body. Accordingly, it has been shown that measured MPV levels are affected by thyroid cancers (7,12-15). In this study, an increase in MPV levels was found in patients with thyroid malignancy.

Experimental and clinical evidence indicates that platelet activation during cancer contributes to the progression of the disease (19). Yu et al. (19) reported in their study that the mean MPV level was lower in thyroid cancer cases than in healthy controls, but they stated that the mechanism was not clear. Li et al. (20) showed that thyroid cancer recurrence was significantly increased in those with high MPV values. In the study by Dincel and Bayraktar (17), it was observed that the mean MPV value was significantly increased in papillary thyroid cancer cases compared to goiter or healthy controls (in the analysis performed by us). Baldane et al. (13) showed that the MPV levels were higher in patients with papillary carcinoma than in those with goiter and healthy controls, and that MPV levels decreased significantly after the operation. These researchers also found that the sensitivity and specificity of the threshold value of 7.8 fL for MPV in detecting thyroid cancer were 60% and 80%, respectively. In addition, some studies have reported that the average MPV level is significantly higher in thyroid cancer cases than in healthy controls (6,7,12,14-16). Healthy controls were not used in our study, instead, patients with thyroid disease and thyroidectomy decisions were included in the study. A comparison of MPV levels was conducted between patients with malignancy and a control group of patients. In our study, the mean MPV level in the group with malignancy was found to be significantly higher than the group without malignancy (9.55 fL vs. 9.16 fL). Additionally, logistic regression analysis revealed that MPV level was an independent risk factor for thyroid malignancy. Accordingly, it was determined that for each unit increase in MPV level, the probability of having a thyroid malignancy was 1.6 times higher. In addition to the ROC analysis, the sensitivity and specificity of the 9.45 fL threshold value for MPV in predicting thyroid malignancy were found to be 60.4% and 53.3%, respectively. All these findings show that platelet volume increases significantly in patients with thyroid malignancy and that the MPV level can provide important information in predicting the presence of malignancy in these cases. However, the fact that sensitivity and specificity values were not very high in the ROC analysis limits the use of MPV as a marker in these cases.

In our study, the average MPV levels were found to be similar between genders, operation types, presence of thyroiditis and presence of comorbid diseases, indicating that the MPV level was significantly affected only by the presence of malignancy among the variables in the study. In addition, the similarity of the groups in terms of other variables, which are not independent risk factors for malignancy, significantly increases the power of MPV in predicting malignancy.

Study Limitations

There were some limitations in our study. Since the study only aimed to determine the value of preoperative MPV in predicting thyroid malignancy, postoperative MPV levels were not examined. In addition, healthy controls were not included in the study because it was aimed to

determine whether there were differences in MPV levels among patients who were slated to undergo thyroidectomy.

Conclusion

The findings obtained in this study, which compared only patients who were decided for thyroidectomy, which is a rare situation in the literature, show that MPV levels before thyroidectomy in patients with thyroid cancer are significantly higher than in thyroidectomy patients without malignancy, and that MPV levels in patients who will undergo thyroidectomy can provide valuable information in predicting malignancy.

Ethics

Ethics Committee Approval: The study was conducted after obtaining approval from the Ethics Committee of the University of Health Sciences Türkiye, İstanbul Training and Research Hospital (approval number: 104, date: 18.10.2024).

Informed Consent: Not applicable.

Footnotes

Authorship Contributions: Surgical and Medical Practices - A.Ö., M.M.S.; Concept - A.Ö., M.M.S.; Design - A.Ö., M.M.S.; Data Collection or Processing - A.Ö., M.M.S.; Analysis or Interpretation - A.Ö., M.M.S.; Literature Search - A.Ö., M.M.S.; Writing - A.Ö., M.M.S.

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