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Mean Platelet Volume as a Biomarker for Thyroid Carcinoma

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This study aimed to determine the relationship between mean platelet volume (MPV) and thyroid malignancy by comparing patients who underwent surgery for benign or malignant thyroid diseases. MPV is a useful early indicator of platelet activation. Platelets differ in terms of functional activity and size. Large platelets are relatively new, more reactive, and produce more thrombogenic factors. Therefore, in conditions that involve increased platelet activation, an increase in the proportion of young platelets and MPV is expected. This study involved 146 patients who underwent total thyroidectomy because of benign (99 patients) or malignant (47 patients) diseases of the thyroid. Data on age, sex, MPV, white blood cell (WBC) count, hemoglobin level, and platelet count were collected retrospectively. MPV was significantly higher in patients with malignant thyroid diseases than in those with benign thyroid diseases. Age, sex, hemoglobin level, WBC count, and platelet count did not significantly differ between the 2 groups. MPV was significantly higher in patients with thyroid malignancies than in patients with benign thyroid diseases. We propose that MPV might be an important predictive factor for thyroid malignancies. Further prospective studies with a larger number of patients in high-volume endocrine surgery centers are required to confirm our findings.

Key words: Platelet activation – Thyroid carcinoma – Platelet count – Mean platelet volume.

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Thyroid malignancies constitute 3% of all malignancies, and are the most common type of endocrine malignancies.[1] Thyroid malignancies are between 2 and 4 times more common in women than men, and their incidence has increased in recent years.[2,3] Ultrasonography and fine-needle aspiration biopsy play important roles in the diagnosis and follow-up of thyroid nodules. These investigations have greatly facilitated the differentiation of benign from malignant thyroid nodules, and the selection of appropriate treatments.[4,5] In addition, a variety of parameters that are useful for the diagnosis and follow-up of thyroid nodules have been investigated. One such parameter is the mean platelet volume (MPV), which has been extensively researched in recent years.

MPV is an early indicator of platelet activation.[6,7] Platelets differ in terms of functional activity and size. Large platelets are relatively new, more reactive, and produce more thrombogenic factors.[8] Therefore, in conditions that involve increased platelet activation, an increase in the proportion of young platelets (and thus, in MPV) is expected. Recent studies have indicated that MPV is an important marker of long-term mortality in ischemic cardiovascular disease.[9,10] Furthermore, increased MPV has been detected in a variety of malignancies.[11–13]

In the present study, we aimed to determine the association between MPV and thyroid malignancies in patients who underwent surgery for benign or malignant thyroid diseases. To the best of our knowledge, our study is one of the only pioneer studies to compare the MPV values between patients with benign thyroid disease and those with thyroid malignancies.

Patients and Methods

We collected data retrospectively for this study. The analyses in this article were based on previously conducted studies, and did not involve any new tests on humans or any tests performed by any of the authors. In addition, the personal identifying information of patients was not included in the study.

We retrospectively reviewed the medical data of patients who had undergone total thyroidectomy at our institution for benign or malignant diseases of the thyroid between January 2012 and November 2014. The following data were collected: age, sex, MPV, white blood cell (WBC) count, hemoglobin level, and platelet count.

Patients aged <18 years, those with incomplete data, and those with Hashimoto thyroiditis, myocardial disorders, neurological disorders, diabetes mellitus, chronic renal failure, or chronic pulmonary diseases were excluded from the study, as chronic illnesses can affect platelet function.[14]

Statistical analysis was performed using statistical software (SPSS version 19.0; SPSS, Chicago, IL, USA). Normality was assessed using the Shapiro–Wilk test. For normally distributed values, descriptive results were expressed as the mean ± SD. The independent-samples *t*-test and Kruskal–Wallis test were used to examine differences between groups. Statistical significance was defined as $P < 0.05$.

Results

A total of 146 patients who had undergone total thyroidectomy for benign or malignant thyroid diseases were enrolled in this study. Diagnosis was made via histopathological examination: malignant disease was present in 47 patients, and benign disease was present in 99 patients. Age, sex, and hemoglobin levels did not significantly differ between patients with benign disease and those with malignant disease (Table 1). MPV was significantly higher in the malignant group than in the benign group (8.9 ± 1.1 fL versus 8.3 ± 0.8 fL, $P = 0.002$), but platelet counts were similar in the two groups ($P = 0.159$, Table 1). Similarly, WBC counts did not significantly differ between the malignant and benign groups ($P = 0.092$, Table 1).

The graphical view demonstrated that MPV may be a discriminatory parameter between thyroid cancer and benign thyroid disease is shown in Figure 1.

Discussion

Several clinical studies have investigated the association between platelet counts and survival times in cancer patients. Platelets have been suggested to play an important role in the progression and metastasis of cancer.[15] Activated platelets secrete angiogenic growth factors, which contribute to tumor angiogenesis and thereby promote tumor formation.[16] As the MPV is a significant predictor of platelet activation,[17] we hypothesized that MPV might be related to thyroid malignancies. Kurt *et al*[11] have reported that MPV is high in patients with hepatocellular cancer and may be a diagnostic marker for this cancer. Osada *et al*[12] found signifi-

Table 1 Demographic data and clinical characteristics of the study patients

Variable	Benign group (n = 99)	Malignant group (n = 47)	*P* value
Age, y	52.8 ± 11.1	56.6 ± 14.4	0.116
Female sex, %	79.8	75.1	0.444
Hemoglobin level, g/dl	13.4 ± 1.8	13.1 ± 1.1	0.152
WBC, $10^3/mm^3$	6.2 ± 2.4	6.9 ± 2.1	0.092
Platelet count, $10^3/mm^3$	269.8 ± 71.3	252.2 ± 67.9	0.159
MPV, fL	8.3 ± 0.8	8.9 ± 1.1	0.002*

*$P < 0.05$, indicates a significant difference.

cantly higher MPV values in gastric cancer patients than in healthy controls. Tuncel *et al*[13] reported high MPV values in patients with metastatic colorectal cancer. Consistent with these studies, our study revealed significantly higher MPV values in patients with thyroid malignancies than in patients with benign thyroid disease. Collectively, the above findings suggest that MPV values are significantly increased in patients with malignant disease. However, Aksoy *et al*[18] found lower MPV values in patients with various types of cancers that had metastasized to the bone marrow than in control subjects. Similarly, Mutlu *et al*[19] did not find high MPV values in patients with various types of cancer, but did find low MPV values in patients who experienced thromboembolic events.

MPV has also been an important focus of research in benign thyroid disease. Erikci *et al*[20] detected significantly higher MPV values in patients with subclinical hypothyroidism than in healthy euthyroid controls. Carlioglu *et al*[21] determined significantly higher MPV values in patients with euthyroid Hashimoto thyroiditis than in healthy controls. Although MPV values have also been found to be increased in certain benign diseases, the findings in our current study suggest that an overall increase in MPV values in malignant thyroid diseases was significantly higher than in patients with benign thyroid disorders.

In conclusion, our study, despite being limited by its retrospective design and small sample size, investigated the relationship between MPV and malignant thyroid diseases. The finding that MPV values are significantly higher in patients with a thyroid malignancy suggests that the MPV might be an important predictive biomarker for thyroid malignancies. Further prospective studies with a larger number of patients are required to validate our findings.

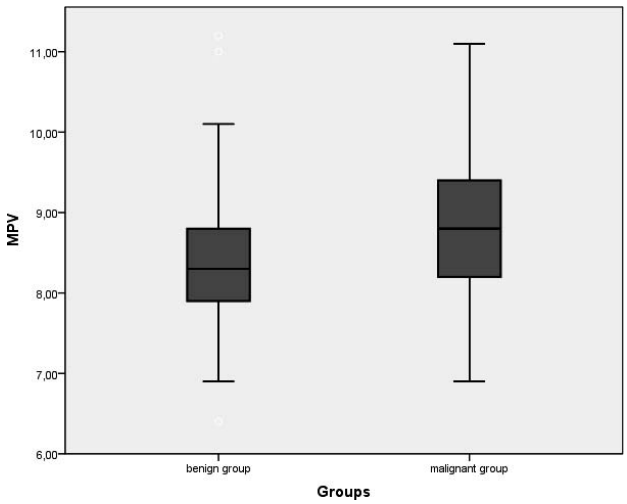

Fig. 1 Graphical view of MPV values in patients with benign and malignant diseases of the thyroid.

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References

1. Trigo JM1, Capdevila J, Grande E, Grau J, Lianes P; Spanish Society for Medical Oncology. Thyroid cancer: SEOM clinical guidelines. *Clin Transl Oncol* 2014;**16**(12):1035–1042
2. Malandrino P, Scollo C, Marturano I, Russo M, Tavarelli M, Attard M *et al*. Descriptive epidemiology of human thyroid cancer: experience from a regional registry and the "volcanic factor." *Front Endocrinol (Lausanne)* 2013;**4**(4):65
3. Dorairajan N, Pandyaraj RA, Anandhi A, Kumar JV, Siddharth D. Differentiated carcinoma of the thyroid: a paradigm shift in surgical approach. *Int Surg* 2008;**93**(3):181–188
4. Kapan M, Onder A, Girgin S, Ulger BV, Firat U, Uslukaya O *et al*. The reliability of fine-needle aspiration biopsy in terms of malignancy in patients with Hashimoto thyroiditis. *Int Surg* 2015;**100**(2):249–253
5. Canonico S, Pellino G, Pameggiani D, Sciaudone G, Candilio G, De Fatico GS *et al*. Thyroid surgery in the elderly: a comparative experience of 400 patients from an Italian university hospital. *Int Surg* 2014;**99**(5):523–527
6. Inagaki N, Kibata K, Tamaki T, Shimizu T, Nomura S. Prognostic impact of the mean platelet volume/platelet count ratio in terms of survival in advanced non-small cell lung cancer. *Lung Cancer* 2014;83(1):97–101
7. Karaman H, Karakukcu C, Kocer D. Can mean platelet volume serve as a marker for prostatitis? *Int J Med Sci* 2013;**10**(10): 1387–1391

8. Demirin H, Ozhan H, Ucgun T, Celer A, Bulur S, Cil H *et al*. Normal range of mean platelet volume in healthy subjects: Insight from a large epidemiologic study. *Thromb Res* 2011; **128**(4):358–360
9. Azab B, Torbey E, Singh J, Akerman M, Khoueiry G, McGinn JT *et al*. Mean platelet volume/platelet count ratio as a predictor of long-term mortality after non-ST-elevation myocardial infarction. *Platelets* 2011;**22**(8):557–566
10. Slavka G, Perkmann T, Haslacher H, Greisenegger S, Marsik C, Wagner OF *et al*. Mean platelet volume may represent a predictive parameter for overall vascular mortality and ischemic heart disease. *Arterioscler Thromb Vasc Biol* 2011; **31**(5):1215–1218
11. Kurt M, Onal IK, Sayilir AY, Beyazit Y, Oztas E, Kekilli M *et al*. The role of mean platelet volume in the diagnosis of hepatocellular carcinoma in patients with chronic liver disease. *Hepatogastroenterology* 2012;**59**(117):1580–1582
12. Osada J, Rusak M, Kamocki Z, Dabrowska MI, Kedra B. Platelet activation inpatients with advanced gastric cancer. *Neoplasma* 2010;57(2):145–150
13. Tuncel T, Ozgun A, Emirzeoglu L, Celik S, Bilgi O, Karagoz B. Mean platelet volume as a prognostic marker in metastatic colorectal cancer patients treated with bevacizumab-combined chemotherapy. *Asian Pac J Cancer Prev* 2014;**15**(15):6421–6423
14. Incebiyik A, Seker A, Vural M, Gul Hilali N, Camuzcuoglu A, Camuzcuoglu H. May mean platelet volume levels be a predictor in the diagnosis of pelvic inflammatory disease? *Wien Klin Wochenschr* 2014;**126**(13–14):422–426
15. Nash GF, Turner LF, Scully MF, Kakkar AK. Platelets and cancer. *Lancet Oncol* 2002;**3**(7):425–430
16. Zhang W, Dang S, Hong T, Tang J, Fan J, Bu D *et al*. A humanized single-chain antibody against beta 3 integrin inhibits pulmonary metastasis by preferentially fragmenting activated platelets in the tumor microenvironment. *Blood* 2012; **120**(14):2889–2898
17. Park Y, Schoene N, Harris W. Mean platelet volume as an indicator of platelet activation: methodological issues. *Platelets* 2002;13(5–6):301–306
18. Aksoy S, Kilickap S, Hayran M, Harputluoglu H, Koca E, Dede DS *et al*. Platelet size has diagnostic predictive value for bone marrow metastasis in patients with solid tumors. *Int J Lab Hematol* 2008;30(3):214–219
19. Mutlu H, Artis TA, Erden A, Akca Z. Alteration in mean platelet volume and platicrit values in patients with cancer that developed thrombosis. *Clin Appl Thromb Hemost* 2013; **19**(3):331–333
20. Erikci AA, Karagoz B, Ozturk A, Caglayan S, Ozisik G, Kaygusuz I *et al*. The effect of subclinical hypothyroidism on platelet parameters. *Hematology* 2009;**14**(2):115–117
21. Carlioglu A, Timur O, Durmaz SA, Ayhan ME. Mean platelet volume in euthyroid patients with Hashimoto's thyroiditis. *Blood Coagul Fibrinolysis* 2015;**26**(3):282–284