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Association of platelet count and platelet indices with cranial meningioma

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ABSTRACT

Introduction and Objectives: In this study, we aimed to investigate whether platelet count (PLT) and platelet indices included mean platelet volume (MPV), platecrit (PCT), platelet distribution width (PDW) values can be used as diagnostic markers in cranial meningiomas.

Materials and Methods: The study included results of 29 patient and 47 healthy contributors. Based on pathologies, the patients were divided into two groups. The first group included meningioma patients and the second one included healthy individuals. Healthy contributors named control group. Platelet count and platelet indices were determined using Sysmex XN 550 haematology analyzer. The preoperative platelet count (PLT) and platelet indices included mean platelet volume (MPV), platecrit (PCT), platelet distribution width (PDW) values were recorded from the routine laboratory tests.

Results: There was no statistically significant difference in PLT between the meningioma and healthy groups (p = 0.217). There was a statistically significant difference in PCT between the meningioma group and the healthy group (p = 0.002). There was a statistically significant difference in PDW between meningioma group and healthy group (p = 0.001). In terms of MPV, there was a statistically significant difference between meningioma group and the healthy group (p = 0.001)

Conclusion: Platelet count and indices are easily available in the routine blood tests. Despite the retrospective design and small sample size, our findings suggest that altered MPV, PDW and PCT levels might serve as potential biomarkers for the diagnosis of meningiomas.

Keywords
platelet,
platelet indices,
inflammation,
meningioma

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INTRODUCTION

Platelets are reproduced from megakaryocytes[1]. We know that platelets play an important role in the coagulation process. Platelets have been studied for many years for their vital role in tumorigenesis. Many different mechanisms of the relationship between cancer cells and platelets have been demonstrated. Newly, platelets were declared to be associated with the development and progression of malignan-

cies[2,3]. The relation between cancer and inflammation was identified in the last century. As known, neutrophils, and lymphocytes are responsible for inflammation. New studies reported that platelets play a major role in inflammation[4,5]. Platelets are the first to accumulate at the site of damage and they secrete proinflammatory and growth factors such as platelet activated factor (PAF), vascular endothelial growth factor (VEGF), platelet derivate growth factor (PDGF), and thromboxane A2 at the injured area. VEGF plays a key role in regulating angiogenesis via increasing vascular permeability and facilitating the branching and formation of new blood vessels in the tumor site [6].Meningioma is a central nervous system tumor arising from the arachnoid cells present in the arachnoid mater. It is the most common benign primary tumor of the brain. Currently, there is still no consensus for biomarkers that can be used for early diagnosis and prognosis for meningiomas. In this study, we used platelet indices for the search of potential biomarkers for meningiomas.

Materials and methods

The study included results of 29 patient and 47 healthy contributors. The patients underwent surgery. Patients' laboratory and pathology results were retrospectively reviewed from the hospital archive. Based on pathologies, the patients were divided into two groups. The first group included meningioma patients and the second one included healthy indivudials. Healthy contributors named control group. Platelet count and platelet indices were determined using Sysmex XN 550 hematology analyzer. The preoperative platelet count (PLT) and platelet indices included mean platelet volume (MPV), platecrit (PCT), platelet distribution width (PDW) values were recorded from the routine laboratory tests.

Statistical analysis

The R 3.2.1 package program was used to analyze data. Descriptive statistics of the quantitative variables included in the study were determined by mean, standard deviation, median, minimum and maximum values; qualitative variables are indicated by frequency and percentage. The suitability of the continuous variables to the normal distribution was examined by the Shapiro Wilk test. Mann Whitney U test was used to compare two groups of continuous variables that do not show normal distribution. The relationships between continuous variables were interpreted with the Pearson correlation coefficient. Pearson chi-square and Yates chi-square tests were used to comparing qualitative variables between groups. In all statistical analyzes in the study, p values less than 0.05 were considered statistically significant.

Results

A total of 76 contributors were included in this study. 29 of them meningioma patients, and 47 of them were healthy contributors**.** There was no statistically significant difference in PLT between the meningioma and healthy groups (p = 0.217)(Figure 1). There was a statistically significant difference in PCT between the meningioma group and the healthy group (p = 0.002)(Figure 2). There was a statistically significant difference in PDW between meningioma group and healthy group (p = 0.001)(Figure 3). In terms of MPV, there was a statistically significant difference between meningioma group and the healthy group (p = 0.001)(Figure 4).

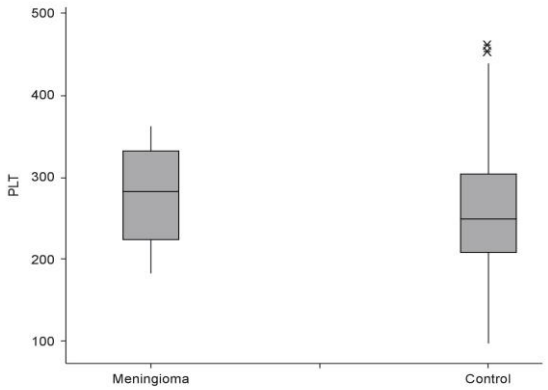

Figure 1. Comparison of PLT levels between the patients and the healthy control group.

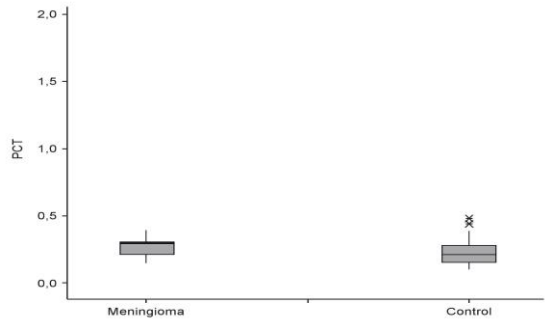

Figure 2. Comparison of PCT levels between the patients and the healthy control group.

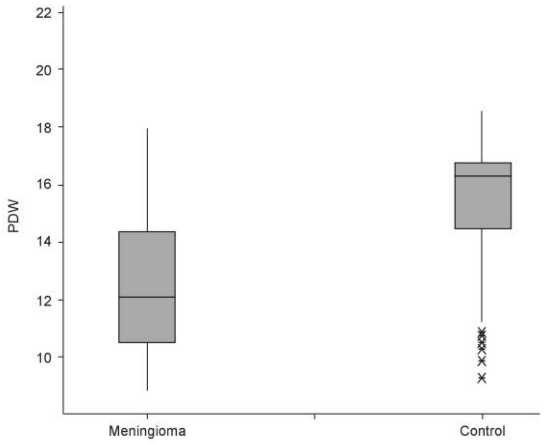

Figure 3. Comparison of PDW levels between the patients and the healthy control group.

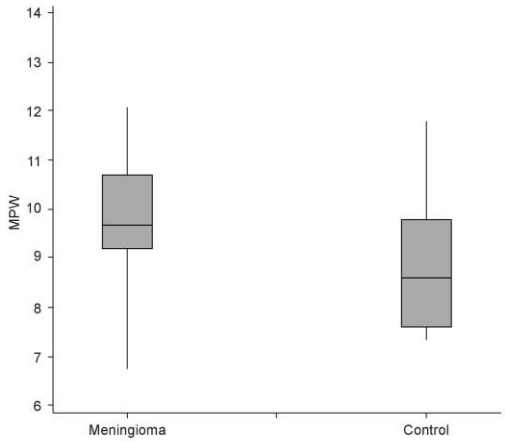

Figure 4. Comparison of MPV levels between the patients and the healthy control group.

Discussion

Although it is known that genetic factors are essential in the development of cancer, the host inflammatory response is reported to be very important in the underlying mechanism of carcinogenesis [7]. Releasing inflammatory cytokines and chemokines in the damaged areas caused platelet activation. Platelets facilitate endothelial adhesion of leukocytes. Recently, researchers suggest that platelets act an important role in neoplastic disease. They put forward that platelets cause encapsulation of neoplastic cells and provide them to get out of recognition by the host immune system [8,9]. Meningiomas are the common benign neoplasms of the central nervous system. They appear approximately 20 percent frequently in all of the brain tumors and risk factors for these neoplasms are still little known [10]. High level of different cytokines which is multiple pathways of carcinogenesis was found in brain tumor specimens [11]. Platelets increase megakaryocytes and pro-inflammatory cytokines released by cancer [12].

In this study, we aimed to measure PLT and it's indices in patient with meningioma, and healthy group. PDW values were found significantly lower in meningioma group compared to the healthy control group but PCT and MPV values were found significantly higher in meningioma group compared to the healthy control group. Numerous study proposes that PLT increases in many cancer types also some others propose that no changes in PLT. Taucher et al showed that platelet count is significantly higher in patients with breast cancer compared with the control group [13]. Inagaki et al found that platelet count is significantly higher in patients with non-small cell lung cancer [14.] Ma, Ozaksit and Okuturlar et al established that there were no statistical changes in PLT while compared the groups similarly to our study [15, 16, 17]. In our study, we found no statistical changes in PLT while comparing the groups. The average platelet volume in the blood mean MPV and heterogeneity in platelet volume mean PDW. MPV is generally used for determining the platelet activity and function in the platelet indices [18]. Theoretically, reduction in platelet counts causes stimulation of megakaryocytes and they are transformed into large platelets [19]. Larger platelets are more metabolically and enzymatically active than smaller platelets [20]. Cho et al. found that patients with hepatocellular carcinoma had higher MPV. In our study, we found statistical higher MPV level in meningioma patients compared to the healthy group. Inagaki N and Kumagai S et al. showed that the patients had non-small cell lung cancer with poor prognosis had low MPV levels [14, 21]. There are different results in PDW in many research. Inagaki et al. found lower PDW levels similarly our study in non-small cell lung cancer [14]. Okuturlar et al. showed no statistical difference between breast cancer patients and the healthy groups in PDW [17]. Ma et al. found that increase PDW levels in epithelial ovarian cancer [15]. Xuegong et al. have established that the level of PCT is higher in patients with epithelial ovarian cancer compared to the healthy group [22]. Ozaksit et al. showed that there is no difference between the malignant and benign ovarian masses and the control group in terms of

PCT values [16]. We found statistical lower levels of PCT in meningioma patients compared with the healthy group.

Conclusion

We suggest that the usability of PLT and indices in the early diagnosis of meningioma patients and should be researched by further studies that have larger populations diagnosed with meningioma and their grades.

References

1. George JN. Platelets. Lancet. 2000;355(9214):1531–1539.
2. Franco, A. T. Corken, A. & Ware, J. Platelets at the interface of thrombosis, inflammation, and cancer. Blood 126, 582–588, https:// doi.org/10.1182/blood-2014-08-531582 (2015).
3. Buergy, D. Wenz, F. Groden, C. & Brockmann, M. A. Tumor-platelet interaction in solid tumors. Int J Cancer 130, 2747–2760, https://doi.org/10.1002/ijc.27441 (2012).
4. Balkwill F. & Mantovani A. Inflammation and cancer: back to Virchow? Lancet. 2001;357:539-45.
5. Tozkoparan E, Deniz O, Ucar E, et al. Changes in platelet count and indices in pulmonary tuberculosis. Clin Chem Lab Med. 2007;45:1009-13.
6. Cai J, Ma H, Huang F, et al (2013). Correlation of bevacizumab induce hypertension and outcomes of metastatic colorectal cancer patients treated with bevacizumab: a systematic review and meta-analysis. World J Surg Oncol, 11, 306.
7. Coupland LA, Parish CR (2014). Platelets, selectins, and the control of tumor metastasis. Semin Oncol, 41, 422-34.
8. M. R. Barnard, L. A. Krueger, A. L. Frelinger III, M. I. Furman, and A. D. Michelson, "Whole blood analysis of leukocyte-platelet aggregates," Current Protocols in Cytometry, 2003.
9. R. Leblanc and O. Peyruchaud, "Metastasis: new functional implications of platelets and megakaryocytes," Blood, vol. 128, no. 1, pp. 24–31, 2016.
10. Sergentanis TN, Tsivgoulis G, Perlepe C, Ntanasis-Stathopoulos I, Tzanninis IG, Sergentanis IN, Psaltopoulou T. Obesity and Risk for Brain/CNS Tumors, Gliomas and Meningiomas: A Meta-Analysis. PLoS One. 2015;10:e0136974. [PMC free article] [PubMed] [Google Scholar]
11. Albulescu, R.; Codrici, E.; Popescu, I.D.; Mihai, S.; Necula, L.G.; Petrescu, D.; Teodoru, M.; Tanase, C.P. Cytokine patterns in brain tumor progression. Mediat. Inflamm. 2013, 2013, 979748. [CrossRef] [PubMed]
12. 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;19:331-3.
13. Taucher S, Salat A, Gnant M, Kwasny W, Mlineritsch B, et al. (2003) Impact of pretreatment thrombocytosis on survival in primary breast cancer. Thromb Haemost 89(6): 1098-1106.
14. Inagaki N, Kibata K, Tamaki T, et al (2014). Prognostic impact of the mean platelet volume/platelet count ratio in terms of survival in advanced non-small cell lung cancer. Lung Cancer, 83, 97-101.
15. Ma X, Wang Y, Sheng H, et al (2014). Prognostic significance of thrombocytosis, platelet parameters and aggregation rates in epithelial ovarian cancer. J Obstet Gynaecol Res, 40, 178-83.
16. Ozaksit G, Tokmak A, Kalkan H, et al (2015).Value of the platelet to lymphocyte ratio in the diagnosis of ovarian neoplasms in adolescents. Asian Pac J Cancer Prev, 16, 2037-41.
17. Okuturlar Y, Gunaldi M, Tiken EE, et al (2015). Utility of peripheral blood parameters in predicting breast cancer risk. Asian Pac J Cancer Prev, 16, 2409-12.
18. Gasparyan AY, Ayvazyan L, Mikhailidis DP, Kitas GD. Mean platelet volume: a link between thrombosis and inflammation? Curr Pharm Des. 2011;17(1):47–58.
19. Alsweedan SA, Al-Shurman A, Mahmoud AS (2008). Diagnostic value of platelet indices in children with leukemia. J Pediatr Hematol Oncol, 30, 953-5.
20. Kannar V, Raja V, Suresh TN (2017) Evaluation of platelet indices in oral squamous cell carcinoma. Clin Cancer Investig J 6(1): 40-43.
21. Kumagai S, Tokuno J, Ueda Y, Marumo S, Shoji T, Nishimura T, Fukui M, Huang CL. Prognostic significance of preoperative mean platelet volume in resected non-small cell lung cancer. Mol Clin Oncol. 2015;3:197-201.
22. Xuegong Ma, Yingmei Wang, Hongna Sheng, Wenyan Tian, Zheng Qi, Fei Teng, Fengxia Xue. Prognostic significance of thrombocytosis, platelet parameters and aggregation rates in epithelial ovarian cancer. Journal of Obstetrics and Gynaecology Research 2014, 40 (1): 178-83.