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Research Article

Comparison of Platelet Counts and Mean Platelet Volume Levels in Skin Cancer Patients and Healthy Individuals

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Abstract

Objective: The aim of this study was to evaluate the platelet (plt) count, mean platelet volume (MPV) and MPV/plt levels in skin cancer patients and to compare them with healthy individuals.

Patients and Methods: Between January 2005 and February 2013, medical data of 558 patients with primary skin cancer who were treated at Kayseri Training and Research Hospital, Department of Plastic Surgery and Radiation Oncology were retrospectively analyzed. Age and sex of the patients, histopathological subtype of cancer and platelet and MPV values which were checked one day before surgery were recorded. The control group consisted of 308 healthy volunteers who were admitted to Kayseri Training and Research Hospital, Check-Up Outpatient Clinic were retrospectively analyzed. Baseline platelet count, MPV value and MPV/plt ratio of patients and healthy were recorded. Comparison was based on t-test test and one way ANOVA.

Results: A significant difference in age, plt count, MPV value and MPV/plt ratio was observed among the patients with skin cancer and healthy controls ($p<0.001$). There was a significant difference in age, MPV/plt ratio and plt count among the patients with basal cell carcinoma (BCC) and squamous cell carcinoma (SCC) ($p<0.001$), but not malignant melanoma (MM) and healthy controls. There was a difference in MPV among the patients with BCC and healthy controls ($p<0.034$), while no difference was observed among the patients with SCC and MM and healthy controls.

Conclusion: Our study results showed MPV is an indicator for inflammatory process and thrombosis and likely, thus, to be a novel biomarker in the diagnosis of skin cancer.

Keywords: Skin cancer; Platelet; Mean platelet volume

Introduction

Skin, which is the largest part of human body, can be easily exposed to environmental carcinogens in the long-term. Skin neoplasms are the most frequent types of neoplasms. Malignant skin tumors account for the half of the cancers in USA with an increasing incidence [1].

Malignant skin tumors include basal cell carcinoma (BCC), malignant melanoma (MM), squamous cell carcinoma (SCC) and skin appendages. Skin tumors account for 65-75% of BCC, 20-30% of SCC, and 5-10% of MM and skin appendages. Each of them has a unique biological pattern. Although environmental factors and chronic inflammation have been reported to play a role in the etiopathogenesis of skin cancer, it is still unknown [2,3].

Skin cancer has an excellent prognosis if early diagnosed with the lowest mortality following treatment, as these tumors are visible and biopsy samples can be easily taken. The success rate of curative treatment of these tumors is higher due to slow progression. Despite high local recurrence rate, these tumors are less likely to metastasize [2-4].

The best treatment approach is based on the tumor type as well as patient characteristics and treatment parameters. Early stage skin carcinomas are usually managed using a single method such as local excision, radiation therapy (RT), cryotherapy or laser excision, while advanced or late stage carcinomas are managed using a combination therapy including surgery and postoperative RT [2,5].

With the introduction of automatic blood cell counting machines into the laboratories thirty years ago, platelet (plt) analysis including plt count, mean platelet volume (MPV), platelet distribution width (PDW) and plt functions has been carried out effectively. Many studies have been conducted to investigate a possible relationship between plt count and several diseases [6-10]. In addition, the mean platelet volume and PDW values are valid parameters in the diagnosis and management of different types of cancer for many years, and also there are a limited number of studies investigating the relationship between these parameters and cancer [5,15]. Despite being the most frequently seen malignancies, the relationship between skin tumors and blood parameters is still unknown. Today, no serum biomarker is known in the diagnosis of skin cancer.

In this study, we aimed to compare the plt count, MPV and MPV/plt ratio among the patients with skin cancer and healthy individuals.

Material and Methods

Between January 2005 and February 2013, medical data of 558

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Table 1: A comparison of blood parameters among the patients and healthy controls.

Parameter	Cancer Group (N:558)	Control Group (N:308)	P value (<0.05)
Age (year)	69.32±14.13	63.84±10.54	<0.001
Plt (x10^9/L)	240.94±69.50	276.41±88.79	<0.001
MPV(fL)	8.70±1.44	8.46±1.30	0.014
MPV/Plt	0.039±0.014	0.032±0.015	<0.001

The groups in the same column with different numbers are statistically significant (p<0.05).
Values are expressed as mean ± standard deviation.

patients with primary skin cancer (Group 1) who were treated at Kayseri Training and Research Hospital, Department of Department of Plastic Surgery and Radiation Oncology were retrospectively analyzed. The control group (Group 2) consisted of 308 healthy individuals who were admitted to Check-Up Outpatient Clinic using a computer-generated random sequence. Age and sex of the patients and histopathological subtype of cancer were recorded. Platelet and MPV values which were checked one day before surgery were also recorded. Patients with missing information were excluded. Platelet count, MPV value and MPV/plt ratio of patients and healthy controls were statistically analyzed.

Statistical analysis

Statistical analysis was performed using SPSS v15.0 software. Quantitative parameters were compared by using independent t-test. One-way variance analysis (one-way ANOVA) was used for comparisons between groups regarding mean values, standard deviation, lowest and highest intervals; while Duncan HSD post hoc test was used to detect groups causing difference. p<0.05 was considered to be statistically significant.

Results

A total of 866 participants including 558 patients with skin cancer (group 1) and 308 healthy controls (group 2) were included. Of them, 592 were men and 274 were women. The male to female ratio was 2:1. In Group 1, 401 patients were diagnosed with BCC, 144 with SCC and 13 with MM. The median age was 69.3 and 63.8 in Group 1 and Group 2, respectively.

A comparison of blood parameters among the patients and healthy controls is shown in Table 1. The mean MPV was 8.70±1.44 in Group 1 and 8.46±1.30 in Group 2. The mean plt count was 240.94±69.5 in Group 1 and 276.41±88.7 in Group 2. The MPV/plt ratio was 0.039±0.014 in Group 1 and 0.032±0.015 in Group 2. There was a statistically significant difference in age, plt, MPV value and MPV/plt ratio between the groups (p<0.001).

Table 2: A comparison blood parameters based on sex of the cancer patients.

Parameter	Male	Female	*P value (<0.05)*
Age (year)	66.56±12.33	69.11±14.86	0.089
Plt (x10^9/L)	226.0±75.9	257.0±76.9	0.067
MPV(fL)	8.63±1.42	8.86±1.46	0.539
MPV/Plt	0.04±0.02	0.03±0.02	0.505

The groups in the same column with different numbers are statistically significant (p<0.05).
Values are expressed as mean ± standard deviation.

The mean age was 66.56±12.33 in men and 69.11±14.86 in women. The mean plt count was 226.0±75.9 in men and 257.0±76.9 in women. The mean MPV was 8.63±1.42 in men and 8.86±1.46 in women. There was not statistically significant relationship between age, plt, MPV and MPV/Plt values between sex of the cancer patients (p>0.05) (Table 2).

A comparison of age, sex, plt count, MPV value and MPV/plt ratio among the patients with skin cancer and healthy controls is shown in Table 3. The mean age was 63.8±10.5 in healthy controls, 68.6±13.9 in patients with BCC, 71.8±14.1 in patients with SCC and 62.0±16.8 in patients with MM. The mean plt count was 276.4±88.7, 241.81±68.9, 238.9±72.2 and 236.5±57.5, respectively, while the MPV/plt ratio was 0.03±0.01, 0.03±0.01, 0.03±0.01 and 0.03±0.01, respectively. There was a significant difference in age, MPV/plt ratio and plt count among the patients with BCC and SCC and healthy controls. There was a difference in MPV among the patients with BCC and healthy controls (p<0.034), while no difference was observed among the patients with SCC and MM and healthy controls.

Discussion

Most of patients with cancer may experience several hematological problems. Such problems may be directly linked with primary diseases or secondary to management modalities administered to the patient. Primary disease-related problems may result from paraneoplastic syndrome or local invasion of tumor. Although the incidence of paraneoplastic processes which may influence the hematopoietic cells and coagulation factors is very high in these patients, the underlying etiology remains to be elucidated [11-15].

In our study, the mean plt count was a significant difference. Reactive thrombocytosis was frequently seen in malignant tumors. Although it is well-established that reactive thrombocytosis results from increased plt production, the underlying culprit is still unknown [12-15]. In a study involving a total of 1000 patients with head and neck, lung, colon and prostate cancer, the authors reported that the most common abnormality was hyperfibrinogenemia (51%), followed by thrombocytosis (45%) [15]. Although it is believed that the interaction between tumor cells and plt count likely contribute to the metastatic disease with a poor diagnosis, the prognostic significance of plt count is still controversial [11,12]. On the other hand, several studies demonstrate that plt count was an important prognostic factor in certain types of cancer, indicating a poor prognosis, unlikely to some studies indicating that plt count was a predictive factor [13,14]. Reactive thrombocytosis may also develop in response to hemorrhage, hemolysis, infectious and inflammatory diseases and carcinomas [16]. There are still ongoing studies which investigate the clinical significance of these changes in plt counts. In our study, we observed a decrease in the plt count, in contrast to the literature data.

Megakaryocytes which are the main stem cells of plt are produced in the bone marrow at the ratio of 85-90% and in the lungs at the ratio of 10-15%. Hence, the MPV, a biomarker of plt functions and activation, is measured to identify the exact size of platelets [6,7]. Several diseases influencing the plt count may lead to impairments in the plt volume and functions. As the plt reproduction increases, the MPV which is a hemostatically significant physiological variable

Table 3: A comparison of age, plt count, MPV value and MPV/plt ratio among the patients with skin cancer and healthy controls.

Parameter	Control (N:308)	BCC (N:401)	SCC (N:144)	MM (N:13)	*P* value *(<0.05)*
Age (year)	63.84±10.54[23]	68.65±13.91[13]	71.83±14.18[1]	62.07±16.83[3]	<0.001
Plt (x10^9/L)	276.41±88.79[23]	241.81±68.98[13]	238.92±72.25[12]	236.5±57.57	<0.001
MPV (fL)	8.46±1.30[2]	8.75±1.45[1]	8.54±1.44	8.82±1.20	0.034
MPV/Plt	0.032±0.014[23]	0.039±0.015[1]	0.037±0.016[1]	0.030±0.01	<0.001

[1234]: The groups in the same column with different numbers are statistically significant (p<0.05).
Values are expressed as mean ± standard deviation.

also increases. A high number of platelets become reactive, thereby leading to an increased number of prothrombic factor and easy accumulation. This process is also known to result in micro and macrovascular pathologies [8,16].

Higher MPV values often lead to increased production of plt and coagulation factors. Several diseases and treatments including cardiovascular diseases, malignancies, myeloproliferative conditions, splenectomy, rheumatoid arthritis, iron deficiency anemia, exercise, erythropoietin therapy, acut infections and thyrotoxicosis are known to increase the MPV value, whereas idiopathic thrombocytopenic purpura, certain types of leukemia, aplastic anemia, pernicious anemia, hypersplenism, thrombotic thrombocytopenic purpura, massive blood transfusion, infectious diseases and hypoplastic bone marrow decrease the MPV value. Low levels of MPV, which are rarely seen, are often associated with severe diseases such as leukemia [17-26].

In our study, the mean MPV was a statistically significant difference. Higher MPV values in patients with BCC and SCC compared to healthy controls also indicated a statistically significant difference. This difference was not observed among patients with MM and healthy controls. This may be explained by small sample size.

On the other hand, MPV has shown to play an important role in the thrombocytic and inflammatory processes of several diseases. In addition to other inflammatory parameters, MPV is an easy and useful parameter without any additional cost. Several studies have also shown that MPV may vary according to the regional origin. For instance, Mediterranean people typically have a higher value of MPV [27-29]. A study involving 5,000 participants revealed that the MPV ranged between 7 to 15 fL [28]. Similarly, Demirin et al. [29] reported that the MPV ranged between 8.9±1.4 fL (range, 7.2 to 11.7 fL) in healthy Turkish participants. In addition, several studies demonstrated that the MPV was 9.2 fL in patients with a history of heart attack and 8.5 fL in healthy individuals. Patients with a MPV value of 11.3 fL were also diagnosed with asymptomatic coronary artery disease. A MPV value of 10.4 was also reported to be a predictor for acute coronary syndrome [18,24-26]. Similarly, Chu et al. [26] reported that increased MPV was an independent risk factor for myocardial infarction. On the other hand, MPV values decreased in patients with rheumatoid arthritis, familial Mediterranean fever, ankylosing spondylitis or inflammatory bowel disease [16,23].

There are a limited number of studies investigating the relationship between plt indices and different types of cancer. Osada et al. [13] reported that MPV was a highly diagnostic parameter in patients with neoplastic diseases, gastric cancer in particular. Similarly, Aksoy et al. [14] observed that higher MPV values were predictive for metastatic bone marrow in patients with solid tumors. Also, Cho et al. [30] reported that MPV/plt ratio was likely to be a biomarker for the presence of tumor in patients with hepatocellular cancer. In our study, we also found increased MPV values in patients with skin cancer.

Conclusion

Results of our study show that there is a significant difference in plt count, MPV and MPV/plt ratio among the patients with skin cancer and healthy individuals. We conclude that MPV is an indicator for inflammatory process and thrombosis and likely, thus, to be a novel biomarker in the diagnosis of skin cancer.

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