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Original Article

Analysis of mean platelet volume and red blood cell distribution width in recurrent epistaxis

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ABSTRACT

Objectives: Recurrent epistaxis is one of the most common causes of emergency department visits. Although several localized and systemic conditions has been described, the exact cause is unknown in the majority of cases. In our study, we aimed to determine the effect of mean platelet volume (MPV) and red blood cell distribution width (RDW) levels on recurrent epistaxis.

Method: One hundred and thirty six patients with recurrent epistaxis and 170 healthy cases as control group were included in the study. Demographic data, vital signs and the results of complete blood counts were recorded. The patients who had clinical conditions that might affect the levels of MPV or RDW, were excluded. MPV and RDW levels were compared between the two groups.

Results: The median level of MPV was 7.6 fL (IQR25–75%: 7.1–8.4) in the study group and 8.2 fL (IQR25–75%: 7.8–8.9) in the control group ($p < 0.001$). The median levels of RDW were found in the patient and control groups in order %15.4 (IQR25–75%: 14.5–15.4) and %14.3 (IQR25–75%: 13.4–15.4) ($p < 0.001$). Systolic blood pressure, leukocyte count, age, sex, RDW and MPV levels that were variables with p levels<0.2, were included in the multivariate analyses. It was determined that high RDW levels increased epistaxis ($p < 0.001$; OR:1.89 [95% CI:1.53–2.33]) and high MPV levels decreased epistaxis ($p < 0.001$; OR:0.54 [95% CI:0.39–0.72]).

Conclusion: Low MPV and high RDW levels caused an increased bleeding tendency in patients with recurrent epistaxis. Although exact mechanism is not known, referring those patients for the assessment of etiologic causes would be proper.

1. Introduction

Epistaxis is one of the most common causes of bleeding which is managed and treated in emergency departments frequently. Although it has been described several localized conditions (such as digital trauma, allergic rhinitis, nasal septal deformity, septal perforations, nasal sprays with antihistaminic or steroid, nasal foreign bodies, aneurysm, nasal papilloma, adenocarcinoma) and systemic conditions (such as hypertension, clotting disorders, bleeding diathesis, vascular and cardiovascular diseases), the cause of epistaxis are unknown in the majority of cases.[1]

Several studies have been published recently that research whether there are any relationships between epistaxis and various blood parameters, the most obvious of which are mean platelet volume (MPV) and red blood cell distribution width (RDW).[2–4] It was revealed that high MPV values lower the frequency of epistaxis.[2] Platelets are made up of megakaryocytes in the form of a disc and responsible for coagulation. MPV value is one of the important parameters that determine the function of platelet. MPV is an important variable, and in metabolic and enzymatic aspects, big platelets were shown to be more active than small platelets.[5] Big platelets involve more prothrombic factors, such as thromboxane A_2, beta-thromboglobulin, and adhesion molecules. Thromboxane A_2 functions in the aggregation of vasoconstrictors

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and platelets.[6–8] Increased MPV value is associated with shortened bleeding period.[9] It has also been reported that increase in platelet volume is associated with acute myocardial infarction (AMI), acute cerebral ischemia and transient ischemic attacks.[6–8] RDW value is a criterion for the variability in the erythrocyte population.[10] Increased RDW can be seen in a large number of diseases which cause reticulocytes to be released into circulation before maturation. As well as being the distinctive diagnosis of anemia, increased RDW values were found to be associated with heart failure, cardiovascular events, celiac disease and inflammatory intestinal disease activity.[11] Also, increase in RDW level was determined to be associated with increased inflammatory markers.[12,13]

In this study, our purpose is to find out whether there is any relationships between recurrent epistaxis and MPV and RDW values.

2. Material and methods

2.1. Study design

This retrospective, case-contol study was conducted by examining the files of the patients who were presented to the Emergency Department of Keçiören Training and Research Hospital between November 15, 2014 and November 15, 2015 due to epistaxis. Approval from the local ethical committee was obtained before the study began. The presentation of the patients to hospital with epistaxis at least twice during the previous year was considered as recurrent epistaxis. Demographic data of these patients, their vital signs and the results of their complete blood count were recorded. The patients aged under 18 and over 65, those with traumatic epistaxis, pregnant women, the patients with diseases that may lead to changes in MPV and RDW parameters (diabetes mellitus, hypertension, anemia, bleeding disorders, cardiovascular diseases, stroke, peripheric vascular diseases, acute infections, thyroid disorders, chronic inflammatory skin diseases, malignancy and chronic drug use) were excluded from the study. The control group was composed of healthy individuals at similar ages and with similar genders, presented to the primary care physician for routine control.

2.2. Statistical analyses

Statistical analyses were performed using SPSS version 15.0 (SPSS, Inc., Chicago, IL, USA). The Shapiro-Wilk test was used to assess the normal distribution of the variables. The data consistent with the normal distribution were expressed as mean ± standard deviation (SD), and those that were not consistent were expressed as median and 25% and 75% quarters (IQR). Pearson chi-square test was used for the comparison of categorical data between the groups, Student-T test was used for the comparison of parametric continuous data and Mann-Whitney-U test was used for non-parametric data. The variables with a p value under 0.2 as well as age and gender were included in the model for a multivariable regression analysis. Of these variables, the ones that could correlate with each other were evaluated with Spearman correlation test. The suitability of the model was assessed with Hosmer-Lemeshow test. $p < 0.05$ was considered statistically significant.

3. Results

In total, 136 patients and 170 control cases were included in the study. 76 patients (55.3%) were male in the patient group, while there were 94 males (55.3%) in the control group. The median age was 38.5 (IQR25–75%: 23.0–51.0) in the patient group and 35 (IQR25–75%: 27.0–46.2) in the control group. No statistically significant difference was detected between the groups ($p = 0.6$). Demographic data and vital signs of the patients are shown at Table 1.

When whole blood count parameters were examined, MPV median value was found to be 7.6 fL (IQR25-75%: 7.1–8.4) in the patient group and 8.2 fL (IQR25-75%: 7.8–8.9) in the control group. There was a statistically significant difference between the groups ($p < 0.001$). Similarly, RDW median value was 15.4% in the patient group (IQR25-75%: 14.5–15.4) and 14.3% in the control group (IQR25-75%: 13.4–15.4). There was also a statistically significant difference between the groups ($p < 0.001$). The other whole blood count parameters which a statistically significant difference was detected between the groups were hemoglobin ($p = 0.010$), hematocrit ($p = 0.002$) and MCV ($p < 0.001$). No statistically significant difference was found between the other variables (Table 2). A multivariable regression analysis was conducted in order to determine the effects of these parameters on epistaxis. Systolic blood pressure, leukocyte, RDW, MPV values with $p \leq 0.2$ as well as age and gender were included in this multivariable analysis. It was found that a high RDW value increased epistaxis ($p < 0.001$; OR:1.89 [95% CI:1.53–2.33]) and a high MPV value decreased it ($p < 0.001$; OR:0.54 [95% CI:0.39–0.72]) (Tables 3 and 4).

4. Discussion

The most important result of this study is that MPV value in the patients who were presented to the emergency department with epistaxis, was lower than that of the healthy controls, whereas RDW value in patients with epistaxis was higher. We found that a high MPV value decreased epistaxis by 0.54-fold (OR:0.54 [95% CI:0.39–0.72]), while a high RDW value increased epistaxis by 1.89-fold (OR:1.89 [95% CI:1.53–2.33]). We believe that a low MPV value and a high RDW value could be predictive for recurrent epistaxis.

RDW is an indicator showing the variability of the sizes of red blood cells in circulation. The increase in RDW value, which traditionally suggests the presence of anemia, in fact shows that the heterogeneity of erythrocyte size in the peripheral blood. Consequently, studies have been conducted to show that RDW value is associated with several vascular incidents. In a study by Çetin et al., the patients with stable coronary arterial disease and the cases with normal coronary arteries in their angiography were compared, and they reported that a high RDW value was associated with the spread and severity of coronary arterial disease.[14] In another study, a correlation between a high RDW value and atherosclerosis of carotid artery was established in patients with hypertension.[15] Some of the researchers found that a high RDW value could be a reflection of chronic inflammation that might lead to vascular incidents.[12,13] In other studies, the existence of a correlation between celiac disease and the activity of inflammatory intestinal disease gives support to the idea that a high RDW value might hint the presence of inflammation.[11,16] It was noted that the effect of inflammation on erythropoiesis and the half-life of erythrocytes in circulation could lead to a high RDW.[17] The only study which identified lower RDW values in patients with recurrent epistaxis than in normal population, belongs to Kemal et al.[2] However, in contrast to this result, we found that high RDW values increased epistaxis episodes by 1.89-fold ($p < 0.001$; OR:1.89 [95% CI:1.53–2.33]) in our study. Just as in the recurrent hidden gastrointestinal bleedings in colorectal carcinomas, an increased blood loss that might result from recurring epistaxis attacks could increases erythropoiesis, which might be the reason why we identified high RDW values in these patients.

MPV is one of the most important markers to show the function and activity of platelets. Increased MPV value is associated with shortened bleeding period.[9] Big platelets are more active than small

Table 1
Comparison of the vital signs between patient group and control group.

	Patient (n = 136) Median (IQR25–75%)	Control (n = 170) Median (IQR25–75%)	p
Age, median (IQR%25–75)	38.5 (23.0–51.0)	35.0 (27.0–46.2)	0.6
Sex n (%)			
Male	76 (55.9)	94 (55.3)	0.9
Female	60 (44.1)	76 (44.7)	
Systolic blood pressure (mmHg)	130 (115–138)	125 (119–130)	**0.006**
Diastolic blood pressure (mmHg)	75 (68–84)	78 (74–82)	0.146
Heart rate (/min)	80.5 (73.2–87.0)	76.0 (71.0–85.0)	**0.024**
Body temperature (°C)	36.5 (36.1–36.8)	36.7 (36.4–36.9)	<**0.001**
Respiratory rate (/min)	16 (14–17)	14 (13–15)	<**0.001**
Oxygen saturation (%)	98 (96–99)	98 (95–99)	0.984

Table 2
Comparison of the whole blood cell count parameters between patient group and control group.

	Patient (n = 136) Median (IQR25–75%)	Control (n = 170) Median (IQR25–75%)	p
Leukocyte count (10^3/μL)	8.1 (6.8–9.7)	7.95 (6.6–9.5)	0.173
Red blood cells (10^6/μL)	4.8 (4.5–5.2)	4.8 (4.6–5.2)	0.378
Hemoglobin (g/dL)	14.1 (12.9–15.1)	14.3 (13.5–15.6)	**0.010**
Hematocrit (%)	42.2 (38.5–44.4)	43.1 (40.0–46.6)	**0.002**
Platelet count (10^3/μL)	230.5 (198.5–273)	234.0 (198.7–276.2)	0.917
Mean corpuscular volume [MCV] (fL)	86.9 (83–88.9)	88.1 (85.9–90.3)	<**0.001**
Mean corpuscular hemoglobin [MCH] (pg)	29.3 (27.7–30.2)	29.5 (28.6–30.5)	0.059
Mean corpuscular hemoglobin concentration [MCHC] (g/dL)	33.7 (32.7–34.5)	33.5 (33.0–34.3)	0.320
Mean platelet volume [MPV] (fL)	7.6 (7.1–8.4)	8.2 (7.8–8.9)	<**0.001**
Red cell distribution width [RDW] (%)	15.4 (14.5–16.4)	14.3 (13.4–15.4)	<**0.001**

Table 3
Univariate logistic regression analysis of different variables for recurrent epistaxis.

	Wald	p	OR (95% CI)
Age	0.45	0.498	1.01 (0.99–1.02)
Sex	3.76	0.053	1.57 (0.99–2.47)
Systolic blood pressure (mmHg)	7.31	0.007	1.02 (1.01–1.04)
Leukocytes (10^3/μL)	3.30	0.069	1.12 (0.99–1.26)
RDW (%)	36.31	<0.001	1.79 (1.48–2.17)
MPV (fL)	24.82	<0.001	0.50 (0.38–0.65)

RDW: red blood cell distribution width.
MPV: mean platelet volume.

Table 4
Multivariate logistic regression analysis of different variables for recurrent epistaxis.

	Wald	p	OR (95% CI)
Age	0.03	0.872	0.99 (0.97–1.02)
Sex	3.16	0.075	1.62 (0.95–2.77)
Systolic blood pressure (mmHg)	3.18	0.075	1.02 (0.99–1.05)
Leukocytes (10^3/μL)	4.84	0.028	1.17 (1.02–1.35)
RDW (%)	35.83	<0.001	1.89 (1.53–2.33)
MPV (fL)	16.85	<0.001	0.54 (0.39–0.72)

RDW: red blood cell distribution width.
MPV: mean platelet volume.

ones, and they include much more prothrombic factors as thromboxane A_2, beta-thromboglobulin and adhesion molecules. Platelets play a major role in atherothrombosis in patients with an unstable coronary syndrome.[18] In literature, increased MPV levels were shown in myocardial infarction, congestive heart failure, cerebrovascular diseases and hypertension.[19–21] Martin et al. showed that increased MPV level is an independent risk factor for recurrent myocardial infarction.[22] Çoban et al. found in their study that MPV was high in patients with impaired glucose tolerance. This result was attributed to micro- and macrovascular complications which occur in type 2 diabetic patients before the diagnosis of diabetes.[23]

Bath et al. showed in another study that a positive correlation existed between stroke risk and MPV. They identified that an increase of 1 fL in MPV value was accompanied by an increase of 12% relative risk in stroke risk. They suggested that this association was independent from other definitive factors.[24] O'Malley et al. noted that there was an increase in MPV levels in patients with thromboembolic stroke, whereas Gaur et al. found that there was a decrease in platelet reactivity in patients with intracerebral bleeding.[25,26] Kemal et al. determined that MPV levels were lower in patients with recurrent epistaxis than in normal population. It was noted that a high level of MPV reduced epistaxis, and this was explained by the fact that bigger platelets allowed better homeostasis in patients with a high level of MPV [2]. Also in our study, it was observed that a high level of MPV decreased epistaxis by 0.54-fold ($p < 0.001$; OR:0.54 [95% CI:0.39–0.72]). Since a rise in MPV value shows the rise in the function and activity of platelets, more functional and more active platelets might be the reason why we detected less epistaxis in these patients.

Epistaxis sometimes may be the first symptom in patients with hypertension. In the literature, there are studies which has found a significant correlation between hypertension and epistaxis.[27,28] However, it is not regarded as an important risk factor for anterior epistaxis. In a study, it was reported that the first symptom in 17% of the patients, presented to the emergency department with a hypertensive attack, was epistaxis.[29] Sarhan et al. revealed that there was not a significant difference between the blood pressure levels of the patients with epistaxis and control group. Furthermore, they noted that the presence of high blood pressure during epistaxis can not establish a causative relationship due to confounding stress and possible white coat effect.[30] Although we found

higher systolic blood pressure values in the patient group than in the control group in our study, we did not observe a statistically significant difference in the diastolic blood pressures between the two groups. We think that this increase in the blood pressure of the patients with epistaxis might be associated with the concern and anxiety caused by bleeding.

The fact that most epistaxis are idiopathic, as well as the presence of many etiological factors make it difficult to precisely understand the mechanism behind bleeding. Based on the study we conducted, we think that a low MPV value and a high RDW value might be predictive for recurrent epistaxis. However, new research that involves more patients is needed for better results.

4.1. Limitations

The study is a single-center retrospective study and the data were obtained from patients' files. Considering the retrospective character of our analysis, the results should be regarded as hypothesis-generating and need to be confirmed in prospective trials.

5. Conclusion

In conclusion, low MPV value and high RDW value in whole blood count, might be helpful in predicting subsequent bleeding in the patients, presented to the emergency department with epistaxis.

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Conflicts of interest

None Declared.

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