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Investigation of RDW and MPV levels in patients with upper gastrointestinal bleeding admitted to the emergency department

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Abstract

Comparison of red cell distribution width (RDW) and mean platelet volume (MPV) levels of patients with upper gastrointestinal bleeding and non-bleeding patients registered in the emergency department. After the approval of the ethics committee, adult patients aged 16 years and over who were detected upper gastrointestinal bleeding at Emergency Service between 01.01.2010 and 31.12.2015 were retrospectively investigated. 102 patients with upper gastrointestinal haemorrhage (UGIH) and 110 healthy individuals were included in the study. There wasn't any statistically significant negative or positive correlation of mpv with any complete blood count parameter. There was a statistically significant difference between the patient and control groups in terms of RDW and MPV values ($p < 0.0001$, $p < 0.0001$, respectively). RDW levels observed higher and MPV levels observed lower in patients with upper gastrointestinal bleeding who were registered to the emergency department. Considering MPV and RDW levels in patients detected upper gastrointestinal bleeding may be useful in predicting the mortality and morbidity. It should also be considered that MPV levels may vary in patients with gastrointestinal bleeding.

Keywords: Upper Gastrointestinal bleeding, RDW, MPV

Introduction

Automatic complete blood count devices provide information about the number and size of cells in the blood. The red blood cell distribution width (RDW) is calculated by dividing the standard deviation of the red blood cell (RBC) volume by the mean corpuscular volume (MCV) [1]. RDW values are an indicator of the change in the volume of red blood cells. Although an increase in RDW value is called anisostosis, there are many studies emphasizing that high RDW values are also associated with poor clinical outcomes in cardiovascular diseases such as heart failure, acute coronary syndrome, elective Percutaneous Coronary Intervention (PCI) applications, infective endocarditis, and pulmonary embolism [2-6]. On the other hand, gastrointestinal bleeding is important in hospitalized patients due to its high mortality and morbidity. However, there is only one study in the literature evaluating the relationship of RDW values with upper gastrointestinal bleeding,

in this study it was emphasized that RDW values increased in the early period and were associated with poor prognosis [7].

At the same time platelets (PLT) play the most important role in maintaining homeostasis. They produce and secrete a large number of bodies which has an important role in coagulation, inflammation, thrombosis and atherosclerosis. In the literature there are many studies showing that increased mean platelet volume (MPV) levels are associated with venous and arterial thrombosis in addition to cardiovascular, cerebrovascular and some inflammatory diseases [8-11]. In some cases MPV levels can also decrease in some inflammatory diseases depending on the patients accompanying conditions [8]. There are also some studies showing that the increase in MPV value, which indicates the measurement of the mean platelet volume, leads to prolong hospitalization and increase the need for transfusion requirement as well as an increase in mortality in upper gastrointestinal bleeding patients [12,13]. In this study, MPV and RDW values were examined in patients with upper gastrointestinal bleeding (UGIH) and patients who did not experience bleeding who were admitted to the emergency department as well as the relationship of these values with other blood parameters.

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Materials and Methods

After the approval of the ethics committee, adult patients aged 16 years and over who were diagnosed with upper gastrointestinal bleeding at Inonu University Medical Faculty Hospital Emergency Service between 01.01.2010 and 31.12.2015 were retrospectively investigated.

Patients diagnosed at an external center and referred to our hospital or diagnosed in our hospital were also included in the study. Age, gender, admission haemoglobin (Hb) and haematocrit (Hct) levels, RDW, MPV, MCV, PLT and International Normalized Ratio (INR) levels were examined. Comorbid diseases, chronic disease and medication use (antiplatelet/anticoagulant agents) were investigated.

Statistical analysis

Datas were analyzed using SPSS 15.0 (Chicago, IL, USA) software. Normally distributed continuous variables were expressed as the mean and standard deviation, and skewed-distributed continuous variables were expressed as the median (minimum–maximum).

The Mann-Whitney U and Kruskal-Wallis H tests were used to analyze for the differences between the groups. Chi square analysis was used to compare the differences between the groups of nominal variables. The Spearman correlation coefficient was used to compare the relationships between variables. The results were evaluated in a confidence interval of 95% and at a significance level of $P < 0.05$.

Results

212 patients were included in the study, 102 patients with UGIH (patient group) and 110 without bleeding (control group). There were 71 men and 31 women in the patient group with a mean age of 60.97 ± 19.3 . The laboratory values of the patient group are shown in table 1.

While 10 patients in the patient group had antiaggregant use (9.8%), 92 patients did not use antiaggregant (90.8%). In the patient group, 1 patient had hepatitis (1 %), 6 patients had gastrointestinal tumor (5.9 %), 1 patient had chronic kidney failure and hemodialysis (1 %), 94 patients had no accompanying disease (92.2 %).

Table 1. Distribution of laboratory values of the patient group

	N	Minimum	Maximum	Mean	SD
WBC ($10^3/uL$)	102	3.80	25.30	10.5941	4.33514
HB (gr/dL)	102	4.60	18.40	11.1029	3.51873
HTC (%)	102	13.70	53.20	33.1412	10.46804
MCV (fL)	102	57.10	140.30	86.7216	10.20572
RDW (%)	102	12.20	39.80	15.9069	3.71162
MPV (fL)	102	6.20	12.30	8.0627	1.07509
PLT ($10^3/uL$)	102	25.00	796.00	264.0000	120.16251
INR	102	.90	1.90	1.1004	0.15551

There was a significant correlation between RDW-PLT and RDW-INR in the patient group. ($r:0.204$, $p: 0.040$ and $r: 0.261$, $p:0.008$ respectively). There was no statistically significant negative or positive correlation of MPV with any parameter in both groups.

In the control group, there were 110 patients with a mean age of 57.6 ± 14.4 years, 71 men and 39 women. The laboratory values of the control group are shown in table 2.

When the control and patient groups were compared, there wasn't a statistically significant difference between the two groups in terms of age and gender. When the other laboratory values of the patient and control groups are compared, excluding PLT and MCV values; there was a significant difference between bleeding and nonbleeding patients (Table 2).

Table 2. Distribution of laboratory values of the control group

	N	Minimum	Maximum	Mean	SD
WBC ($10^3/uL$)	110	5.40	18.70	9.2400	2.81008
HGB (g/dL)	110	10.20	17.90	13.8591	1.63737
HTC (%)	110	30.50	55.00	41.7091	4.84610
MCV (fL)	110	73.00	96.30	86.5291	4.67371
RDW (%)	110	11.80	21.50	13.8473	1.46874
MPV (fL)	110	7.00	12.70	9.3409	1.29822
PLT ($10^3/uL$)	110	150.00	428.00	250.4000	57.48733
INR	110	0.80	1.20	0.9883	.08583

The difference between the patient and control groups in terms of RDW levels was statistically significant ($p < 0.0001$) (Table 3).

Although there was no statistically significant positive or negative correlation of MPV with any parameter in either the control group or the patient group, a statistically significant difference was observed in the MPV levels when the two groups were compared ($p < 0.0001$).

When subgroup analyzes were examined, there was no significant difference between those using antiaggregant and those who did not in terms of age, gender and other laboratory findings. While there was no difference in age and gender between the groups with comorbid diseases, there was a significant difference in the WBC levels among the laboratory findings ($p = 0.03$).

Table 3. Statistical comparison of laboratory values between 2 groups

	GRUP 1 (PATIENT)	GRUP 2 (CONTROL)	P
	Mean (minimum - maximum)	Mean (minimum - maximum)	
HGB (g/dL)	11.10 (4.60 - 18.40)	13.85 (10.20 - 17.90)	< 0.0001
WBC (10^3 uL)	10.59 (3.80 - 25.30)	9.24 (5.40 - 18.70)	0.038
HTC (%)	33.14 (13.70 - 53.20)	41.70 (30.50 - 55.00)	< 0.0001
MCV (fL)	86.72 (57.10 - 140.30)	86.52 (73.00 - 96.30)	NS
RDW (%)	15.90 (12.20 - 39.80)	13.84 (11.80 - 21.50)	< 0.0001
MPV (fL)	8.06 (6.20 - 12.30)	9.34 (7.00 - 12.70)	< 0.0001
PLT (10^3 uL)	264.00 (25.00 - 796.00)	250.40 (150.00 - 428.00)	NS
INR	1.10 (0.90 - 1.90)	0.98 (0.80 - 1.20)	< 0.0001

Discussion

Upper Gastrointestinal Hemorrhage (UGIH) is one of the most common reasons for emergency room admissions [14,15]. On the other hand, UGIH is one of the most important causes of mortality and morbidity among hospitalized patients [16,17].

Limited studies in the literature have shown that RDW and MPV values are associated with increased mortality and morbidity in UGIH patients [12,13,18]. In our study, the differences in RDW and MPV levels between patients with and without gastrointestinal bleeding were examined and possible causes were discussed.

Many studies in the literature have shown that increased RDW levels are related with many acute and chronic diseases including heart failure, ischemic cardiovascular cerebrovascular diseases, carotid atherosclerosis, atrial fibrillation, peripheral artery disease, venous thromboembolism, stent thrombosis and hypertension [2,3,19-21].

Tove Skjelbakken et al. suggests that in general populations, RDW is associated with the development of Myocardial Infarction (MI) independent of cardiovascular risk factors and anemia [22]. Another study in literature suggests that increased RDW levels can be an independent predictor of patients with stent thrombosis underwent primary percutaneous coronary intervention due to ST-Elevation Myocardial Infarction [23].

There are also some studies showing that high RDW leads to an increase in intracerebral hemorrhages and major bleeding after percutaneous coronary intervention [24,25].

As we mentioned above there are many studies which have showed that RDW is an indicator of mortality and morbidity.

But as far as we know, there is only one study compared the effect of RDW levels on UGIH. In that study, it was emphasized that RDW values are elevated in UGIH patients and are associated with poor prognosis [7].

Our study demonstrated that RDW were significantly increased in patients with gastrointestinal bleeding.

It is known that the haemorrhagic processes stimulate erythropoietin production and, consequently, the development of anisocytosis increases. Increased Cytokines like Tumor necrosis alfa, Interleukin 6 and Interleukin 1 in inflammatory events, desensitising erythrocyte progenitors by affecting bone marrow [26,27].

In our study, we found that RDW levels were higher in patients with gastrointestinal bleeding compared to patients without bleeding ($p < 0.0001$). We assumed that because of stress, inflammatory processes and acute decline in hemoglobin; gastrointestinal bleeding caused an increase in RDW by forcing the bone marrow

to produce too much immature erythrocytes.

In our study, MPV values were also examined in addition to RDW in gastrointestinal bleeding. Currently, there are limited studies in the literature evaluating the relationship between UGIH and MPV levels. In Balahan et al. study lower MPV levels were found in UGIH in children with Henoch Schönlein Purpura compared to the normal population [28]. In another study, MPV values were found to be significantly higher in patients with upper gastrointestinal bleeding compared to the control group, however PLT levels were found to be lower [13].

In our study, MPV levels were determined to be significantly lower in patients with gastrointestinal bleeding compared to the control group ($p < 0.0001$). In acute blood loss, it is well-known that while PLT increases, MPV proportionally decreases, albeit indirectly [29]. There are variable data on MPV levels in upper gastrointestinal bleeding in the literature. In the literature review published by Gasparyan et al., MPV values vary in various inflammatory diseases such as chron, ulcerative colitis, rheumatoid arthritis, ankylosing spondyloarthritis. It has been observed that disease-specific pathophysiological mechanisms can lead to both an increase and a decrease in MPV values [8]. In our study, MPV values were lower in patients with upper gastrointestinal bleeding compared to the healthy control group. We assume that this difference may be due to ethnic differences or the differences in the pathophysiological mechanism of inflammatory processes in patients. Further studies are needed to clarify the effect of MPV on gastrointestinal bleeding.

Limitations

Since the long-term results of the patients were not examined in our study, it is not possible to comment on the effects of RDW and MPV levels on mortality and morbidity. The study is in a retrospective design and patients with comorbid diseases and anticoagulant drug use that may affect RDW and MPV values were not excluded from the patient group. It is not known whether the RDW is elevated due to the processes triggered by acute bleeding or if it is the previous elevation.

Conclusion

In our study RDW levels are higher and MPV levels are lower in patients with the upper gastrointestinal bleeding compared to the healthy individuals. Considering the RDW levels patients with gastrointestinal bleeding may be useful in predicting the mortality and morbidity. The role of MPV levels on patients with gastrointestinal bleeding is still dark in the literature. Further studies are needed to clarify this condition.

Conflict of interests

The authors declare that they have no competing interests.

Financial Disclosure

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Ethical approval

Ethics approval was obtained before the study (2016/5-15).

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