

Prognostic value of mean platelet volume in patients with upper gastrointestinal bleeding

Research Article

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Abstract: This study included patients with upper gastrointestinal hemorrhage who were treated in intensive care unit of GATA Haydarpaşa Training Hospital, Division of Internal Medicine during 1 year. Medical and demographic data of the patients were recorded. These patients were followed for 3 months after being discharged from the intensive care unit. Of the 50 patients in the study, 18 were female (36%), 32 were male (64%). The mean age was 47 ± 2 years, and the ages ranged between 17 and 89 years. We did not find any statistically significant results in our evaluation of the relationship between the mean platelet volume and the number of transfusions, endoscopic findings, and prognosis after 3 months of follow-up.

Keywords: Mean platelet volume • Upper gastrointestinal bleeding • Transfusion • Endoscopic findings

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1. Introduction

Mean platelet volume (MPV) is a parameter that is routinely available in results of complete blood counts (CBC). The MPV can be determined easily, but still there are no detailed studies regarding its usefulness. The measurement is the geometric median of the transformed platelet volume according to the systems based on impedance technology. It can also be the result of directly measured platelet volume as determined by some optical systems, such as Bayers [1,2].

Today, after many studies, there are still no specific findings about the relationship of circulating platelet volume and density changes. Although platelet number and volume and also megacaryocyte number and volume have been fully described, the factors affecting this association have not been totally identified [3]. MPV measurement can show platelet production rate or the degree of platelet stimulation. Thus, the aims of this study are to use the MPV measurements that are easy to obtain to better understand the clinical significance

of these results and to reveal the clinical importance of this parameter in patients with upper gastrointestinal hemorrhage. We also searched for a relationship of MPV values to the number of transfusions, endoscopic findings, and prognosis.

2. Material and Methods

This study included 50 patients who were hospitalized because of upper gastrointestinal hemorrhage between August 2006 and February 2007. After the patients were told about their disease and the study, informed consent was obtained from all of them or from their relatives. The patients signed the informed consent knowing that they would not undergo any invasive or noninvasive procedure; the MPV measurement was taken automatically from the same blood sample that was to be used for the diagnosis, follow-up, and treatment of their disease. The same procedure was used with the relatives of the patients who were not able

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Table 1. Summary of the demographic features of the cases with controls and results of the study.

	Numbers	Age (years)	Numbers of Transfusions (Unit)	Endoscopic Findings		Period of staying in Hospital (days)	Mortality	MPV Values (fL)				
				Non-erosive gastritis	Erosive gastritis			First Day	Second day	Third Day	Fourth Day	Fifth Day
Patients	50 (F:18, M: 32)	47±2 (17-89)	2.76	17 (34%)	33 (66%)	5.2 ±2 (2-11)	-	7.5	10.03	8.26	8.4	10.06
Controls	20 (F:10, M: 10)	45±3 (20-65)	-	-	-	-	7.7	7.5	7.3	7.1	7.8	

F: Female, M: Male

to sign the informed consent form themselves because of their health status. Of the 50 patients included in the study, 32 were male, and 18 were female. The patients who could not be examined at the times required by the study were excluded.

The blood samples were collected in tubes containing EDTA and then brought for processing to the GATA Haydarpasa Training Hospital Biochemistry Laboratory under room temperature. The MPV was measured with an Abbott Sapphire Cell-Dyne hematologic analyzer. The normal value of MPV at the GATA Haydarpasa Training Hospital Biochemistry Laboratory was 6 to 9.5 fL. Standard tubes for blood collection that were known to produce the fewest errors in measurement were used, and samples were brought to the laboratory within half an hour. These results were recorded. The follow-up period was 3 months. At the end of that period, the patients' third-month MPV values were measured again.

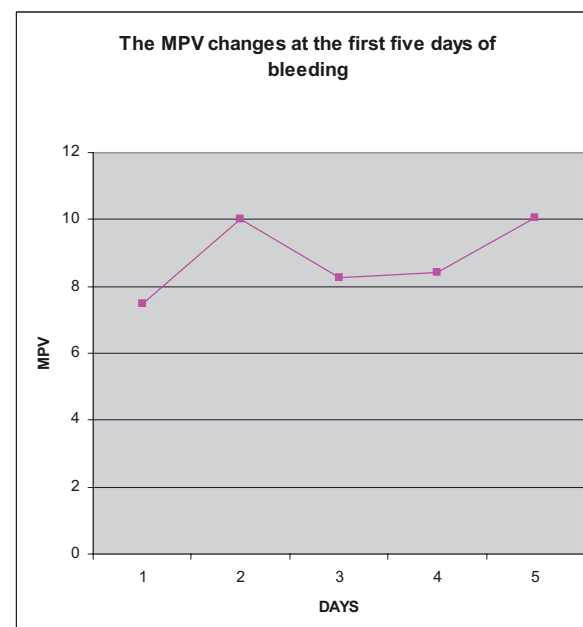
The control group consisted of 20 healthy volunteers. The results were statistically evaluated. The Mann-Whitney U test was used to compare the results. Pearson's correlation test was used to evaluate the MPV in relation to other parameters. The P values, which were less than 0.05, have been accepted as statistically important.

3. Result

Of the 50 patients included in the study, 18 were female (36%), and 32 were male (64%). The mean age was 47±2 (17-89) years. The control group consisted of 20 healthy volunteers; half were male (50%), and half were female (50%). The mean age of the control group was 45±3 (20-65) years.

The mean MPV value on the first day was 7.5 fL, second day 10.03 fL, third day 8.26 fL, fourth day 8.4 fL, and fifth day 10.06 fL. The MPV values of the control group for the first five days were 7.7, 7.5, 7.3, 7.1, and 7.8 fL, respectively (Table 1).

Each of the patients was transfused with an average of 2.76 units erythrocyte suspension. Results of upper

Figure 1. MPV (mean platelet volume) changes during the first five days of the bleeding.

gastrointestinal endoscopy showed that of the 50 patients included in the study, 17 (34%) had nonerosive gastritis, and 33 (66%) had erosive gastritis. The average hospital stay was 5.2±2 (2-11) days.

In this study of patients who presented with upper gastrointestinal bleeding, we tried to correlate the MPV values and the changes in these values (Figure 1) with the number of transfusions, endoscopic findings, and prognosis. There was no statistically significant correlation after 3 months of follow-up.

4. Discussion

This is the first study based on the relationship between gastrointestinal bleeding and MPV. An inverse relationship between platelet number and platelet size exists to keep circulating platelet volume at a constant amount [3]. This relationship can also be seen in other

species. For example, the number of platelets in a rat is approximately 1,200,000/microL, and the MPV value is approximately 2.1 fL; likewise, in a hedgehog, the platelet number is approximately 30,000/microL, and the MPV value is approximately 105 fL. The human? body tries to keep the total platelet volume at a constant amount, not the total platelet number [4,5]. One third of all the platelets in the body are sequestered in the spleen pool in a state that is ready for use. In humans or animals with splenomegaly, the platelet number decreases with the size of the spleen, but the total platelet amount is kept constant [4,5].

In light of this information, we expected that MPV values would increase according to the chronicity and degree of the bleeding to keep the total platelet volume constant. In other words, we expected a positive correlation between MPV values and prognosis. However, after 3 months of follow-up, an unexpected finding was that statistically significant values did not result from the change in MPV and the number of transfusions, endoscopic findings, and prognosis.

There can be many reasons for this occurrence, which may limit the findings of this study. The most important reason may be the short duration (3 months) of follow up. We could have expanded our follow-up by beginning a few days after the bleeding, which would have equaled the platelet life. The second reason may be the acceptance of an insufficient number of patients. Of the patients considered for this study, 29 were not included for three? reasons. First, some patients did not complete the study because of coexisting diseases causing mortality or did not adhere to the requirement of a medical examination after three months. Second, some of the patients who died were excluded from the study because they had very complicated accompanying diseases, and their cause of death was not directly related to the bleeding. The patients who were excluded from the study because of mortality had high MPV values when compared with the others. This finding could indicate that the increased MPV in the patients with bleeding and a coexisting disease like myocardial infarction [6] could have resulted in a poor prognosis related to the coexisting disease, as well. The third reason can be technical problems.

We can classify the technical problems related to the measurement of MPV into three main groups. First, different technologies give different results. For example, Beckman-Coulter uses impedance technology, and the MPV is derived from the statistical evaluation of platelet curve, whereas Bayer devices use laser-based light-spreading technique. Second, the reference rate for MPV changes with the number of platelets. This change reflects the total platelet volume regulatory mechanism

for homeostasis. To calculate the MPV, there must be a nomogram made according to the number of platelets. Third, the calibration of the analyzers for MPV differs from producer to producer, and even results from the same producer can be different at different times [7,8].

Blood samples were collected in tubes containing EDTA, and they were processed by the analyzers after remaining at room temperature for a certain duration, although it is widely known that samples collected in this way may yield some inappropriate results. Previous studies have shown that when EDTA is used as an anticoagulant, the MPV increases with time. In this study, when the MPV was measured 2 hours after blood sampling, the EDTA caused the level to increase up to 0.5 fL. It has been suggested that the swelling of the platelets resulted from different amounts of EDTA in the collecting tubes. To minimize errors in collecting samples, standardized tubes must be used, and blood samples must be processed in the laboratory within 2 hours, and preferably within half an hour. With improvement of new techniques, we can reduce the number of false results [9].

We also showed, as can be seen from the figure, that the MPV value was not constant after the bleeding; it initially increased, then decreased, then reached a plateau, and again increased. This change is probably due to the young platelets entering the circulation.

The MPV measurement is useful in selected clinical conditions. If the consumption of platelets is correlated with improvement of production in vascular diseases, platelet number and volume measurement techniques should be optimized. Standardizing the measurement methods for MPV and stabilizing sample collection techniques will allow a broader usage of the values in association with gastrointestinal bleeding, such as in the detection and follow up of vascular diseases.

Today's studies are more intensely focused on platelets and their association with vascular risks. We now know that more than half of the mortality and morbidity is due to cardiovascular and cerebrovascular diseases. Detection of GP 2b/3a receptors, usage of flow cytometry, and measurement of p-selectine at the platelet surface are extremely expensive and require advanced techniques. However, the MPV determination can be made inexpensively, easily, and rapidly not only for use in cardiovascular diseases but also in other diseases in which gastrointestinal bleeding tends to occur [10-16].

To summarize, although there are no statistically important findings in this study, in light of it, new studies including more cases should be designed to achieve more useful results.

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