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Full Length Research paper

Mean Platelet Volume (MPV) in Intensive Care Unit (ICU) Patients: Is it a useful parameter in assessing prediction for mortality?

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The aim of the study is to investigate MPV (mean platelet volume) showing platelet reactivity if it is associated with the severity of the critical illness or mortality in ICU patients. Study group (130 patients) was formed from survivor group (68 patients) and non-survivor group (62 patients). Platelet counts and MPV values were compared between two groups in the first five days of hospitalization. MPV correlation was studied with APACHE II score, age, haemoglobin level, duration in the ICU and as an independent risk factor in mortality. Mean age and APACHE scores were significantly higher in non-survivor group compared to survivor group (p<0.05). There was no significant difference between two groups according to MPV and platelet counts in first five days of hospitalization. There was a unique positive correlation between MPV and APACHE score (r: 0.34, p< 0.05). Only age was independent risk factor in mortality. In our study, we found positive correlation between severity of critical illness and MPV. However, there was no relation between MPV and mortality in heterogenic critical patients. Subgroup analysis of patients in ICU might be useful in assessing prediction for mortality.

Key words: Mean platelet volume, critical illness, mortality, APACHE, ICU

INTRODUCTION

Mean platelet volume is expected as a possible marker for platelet function. Large platelets contain more dense granules, metabolically and enzymatically more active than small platelets and produce more thromboxane A2 (Corash et al., 1977, Thompson et al. 1982). Increased MPV levels were recognized as an independent risk factor for myocardial infarction and stroke (Cameron et al., 1983, Pizzuli et al., 1998, Endler et al., 2002, Bath et al., 2004). It is also shown that MPV values are high in patients with diabetes mellitus and gestational diabetes mellitus (Hekimsoy et al., 2004, Erikci et al., 2008). An elevated level of the MPV is also related with poor clinical outcome among survivors of myocardial infarction and there is a positive relation between MPV and severity of acute ischemic cerebrovascular events (Pabon et al., 1998, Greisenegger et al., 2004). It was also reported that the MPV in patients with localized infection was normal in all, but about half of the patients with septicemia had increased MPV, not related to the platelet count (Lelie and Borne, 1983). So, we have some studies showing the correlation of the MPV with the poor clinical outcomes of some diseases such as myocardial infarction, acute ischemic serebrovascular events, septicemia, diabetes, and congestive heart failure. However, there is no report on the predictive value or usefulness of MPV in ICU patients who had heterogenic critical illness.

The aim of this study is to investigate predictive value of the MPV to estimate the severity of the critical illness for all causes in ICU patients.

MATERIALS AND METHODS

A retrospective medical ICU based study was carried out on 155 patients between January 2008 and April 2008. The study protocol was approved by the ethics committee of the GATA Training Hospital. Written informed consent was obtained from all cases.

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Table 1. Comparison of survivor and non survivor groups.

	Non-Survivor	Survivor	*P*
Number of patients	62	68	
Age (year)	76.45±11.10	65.73±21.59	**0.001**
Duration of ICU (day)	12.70±10.35	13.59±11.90	0.723
APACHE II Score	17.72±4.99	13.59±5.81	**0.001**
Co morbidities	1.88±0.62	1.83±0.68	0.672
Haemoglobin. g/dl *	10.49±2.84	10.61±2.62	0.820
Mean platelet volume. fL *	8.46±1.52	8.27±1.20	0.460
Platelet count x 10^6 /mL *	204.87±116.92	244.47±118.29	0.070
Diseases			
Sepsis	10 (16%)	5 (7%)	**
Localised infections	18 (29)	13 (19)	**
Renal failure	14 (22)	12 (18)	NS
GIS bleeding	5 (8)	10 (14)	**
Respiratory failure	10 (16)	4 (6)	**
Endocrinologic illness	5 (8)	3 (4)	**
Hemodynamic instability	13 (21)	16 (23)	NS
Others	9 (14)	11 (16)	NS

* value of the first day ** p<0.05 . NS: non significant
Categorical variables were analyzed by x^2 test; continous variables were analyzed by Mann-Whitney U test. Data are presented as the mean value ± SD.

Twenty five of them were excluded from the study because of the inconsistent data, smoking, using some medications (statin, aspirin, clopidogrel, heparin, abciximab) and taking platelet transfusion. Finally 130 patients participated in the study. Two groups were formed:

1-) Nonsurvivor Group: patients died in ICU period, 62 patients, mean age 76 years.

2-) Survivor Group: patients discharged from ICU, 68 patients, mean age 65 years.

Hemoglobin levels, age, APACHE II scores ("Acute Physiology and Chronic Health Evaluation II"), numbers of comorbidities, reasons for admission to ICU, length of stay ICU were compared in survivor and non- survivor groups and all these parameters correlated with the platelet counts and MPV values in first five days. MPV was also studied if it is an independent factor for mortality.

APACHE II is a severity of disease classification system (Knaus et al., 1985), one of several ICU scoring systems. The point score was calculated from 12 routine physiological measurements (such as blood pressure, body temperature, heart rate etc.) during the first 24 hours after admission

MPV measurement had been drawn by taking venous peripheral blood samples into standardized tubes containing dipotassium ethylenedinitro tatraacetic acid (EDTA). All measurements had been performed 30 minute after blood collection on Abbott Cell Dyn Saphire Autoanalyser with time to result approximately 5 minute. Normal value for the MPV in our laboratory is 6.0- 9.1 fL.

Statistical analysis

SPSS (Statistical Package for Social Sciences) for Windows 13.0 programme was used for statistical analysis.The Student's t-test and the one way analysis of variance tests were used for comparing the group means. Spearman correlation coefficient was computed to examine the association between MPV and other variables (APACHE, age, duration of stay in ICU). Levene test and model for regression analysis; The Hosmer-Lemeshow Chi-square test were used to assess the model fit.

RESULTS

Demographic, clinical, and laboratory characteristics in each individual group are listed in Table 1. The mean ages of patients were 76.4±11.1 years and 65.7±21.5 years in non-survivor and survivor groups respectively. We found significant differences in age and APACHE II score between two groups (*p<0.05*). There was no significant difference according to the MPV and platelet counts between non-survivor and survivor groups. There was also no significant difference according to the haemoglobin levels, duration of ICU, number of co-morbidities between two groups (*p<0.05*).

Correlation of MPV with Other Parameters: There was a weak positive correlation between MPV and APACHE II score (r:0.34, p< 0.05) in contrast to other parameters (Table 2). Age was obtained the only predictor factor, by using logistic regression, for mortality in ICU patients, as expected (Table 3) . High MPV was tended to be a possible risk marker in mortality however, it was

Table 2. Correlation between MPV and other parameters

	All patients		Non-survivor group		Survivor group	
	R	p value	r	p value	r	p value
APACHE II	0.338	0.0001	0.317	0.026	0.355	0.006
Duration of ICU	0.08	0.408	-0.006	0.969	0.181	0.152
Age	0.006	0.952	-0.097	0.493	0.028	0.824
Haemoglobin	0.043	0.734	0.056	0.573	0.074	0.682

Data are presented as the Spearman Correlation coefficient and p value.

Table-3: Multivariate logistic regression analysis for independent predictors of mortality in ICU patients.

	Odds Ratio (95% CI)	P value
Age	1.043 (1.014-1.072)	0.004
Platelet count	0.996 (0.991-1.000)	0.031
MPV	1.020 (0.730 – 1.426)	0.907
Haemoglobin	1.049 (0.878 – 1.254)	0.595
Length of stay in ICU	0.984 (0.953 – 1.017)	0.337

insignificant (*p>0.05*).

On the other hand, we looked to the admission reasons to the ICU and it was realized that sepsis, localised infections and respiratory failure were more common in non-survivor group according to the survivor group. Distribution of the other admission reasons to ICU was shown in Table 1.

DISCUSSION

Mean platelet volume (MPV) measurement has been available since 1970s, but neither its relationship with platelet count nor the clinical meaning of this relation has been understood in ICU patients yet. In the present study, we demonstrated that there was a weak positive correlation between MPV and APACHE II score using logistic regression, and only age appeared independent predictors of mortality in ICU patients. In one study, it was shown that MPV was correlated with age and hypertension (Huczek et al.,2005) .However,in our study, MPV was not correlated with age. Though the difference of the mean age between study groups is not that much important for rationale of our study. Even, Selim and co-workers could not find any correlation between MPV and upper-gastrointestinal bleedings before (Nalbant et al.,2009). That study was about a homogeneous group. So, to our knowledge, this is first report about the predictive value or usefulness of MPV in the ICU patients. But we detected no significant difference in MPV values between the patients that died and survived in ICU. In further studies, MPV values in homogenous group of patients might show meaningful results.

Increased MPV was shown to be a risk factor for MI, stroke (Endler et al., 2002) and sepsis (Greisenegger et al., 2004) in previous studies. All of these diseases are life threatening disorders. All of them are associated with increased inflammation and thrombosis. Recently in some studies, it has been shown that MPV values do not increase in every inflammatory process. Kisacik et al, showed that MPV values were significantly lower in both ankylosing spondilitis and rheumatoid arthtitis patients with active disease as compared to controls (Kısacık et al., 2008) . In contrast to that results, Coban et al reported that their results suggest that patients with FMF tend to have an increased platelet activation and this could be contributed to increasing the atherosclerotic risk in FMF patients (Coban and Adanir, 2008).

MPV correlates with platelet function and activation whether measured as aggregation thromboxane synthesis, beta thrombomodulin release, procoaguan function or adhesion molecule expression. MPV is a increased in certain vasculary risk factor states including myocardial infarction, serebrovascular events, congestive heart failure and septicaemia (Bath and Butterworth, 1996).

Congestive heart failure is associated with increased risk of VTE, stroke and systolic dysfunction. This may be related to abnormalities of thrombogenesis and platelet activation. Acute heart failure patients demonstrate some abnormalities of platelet activation compared to stable CHF patients and healthy controls (Chung et al., 2007).

Our patients group did not have cases with acute MI and stroke but sepsis, congestive heart failure and localised infection were present. Frequency of the severe infections was more prevalent in non survivor group than

survivor group. Yilmaz et.al. reported that platelet indices have potential value in the diagnosis and monitoring of dogs and humans with endotoxemia (Yılmaz et al., 2008). The relationship between platelet count and MPV, expressed as means and frequency distributions, showed a correlation with during the course of sepsis (Becchi et al., 2006).

Little is known about effects of various drugs on platelet size. There were no clinical data on possible association of MPV with various platelet inhibitors. However it was shown that clopidogrel significantly inhibits the ADP-induced increase in MPV in vitro (Jagroop and Michailides, 2003). The use of aspirin was also associated with a higher MPV (Nadar et al., 2004). For this reason we excluded the patients from the study using platelet inhibitors last one week. Platelets are known to be affected by smoking (Nair et al., 2001). Smoking patients were also excluded from the study.

One of the limitations of our study might be the timing of MPV value determination. The mean hospitalization duration of survivor and non-survivor groups was the same. So, instead of initially MPV values last days MPV values might be more useful.

We tried to present a relation between MPV and clinical severity of critical illness in ICU patients using a APACHE II score, as a first time. We think that high MPV might be a predictive marker for thromboembolism propylaxis in ICU patients otherwise contraindicated.

Conclusion

In conclusion therefore, MPV values might be a possible and important laboratory parameter in future. So, this simple, effortless and cost effective tool should be extensively investigated to predict severity of the critical illness for ICU patients. However, we detected no correlation between high MPV values and mortality in heterogeneous group of patients. Further studies on more homogenous patients might show whether MPV values have predictive effect on mortality or not.

REFERENCES

Bath P, Algert C, Chapman N, Neal B (2004). Association of mean platelet volume with risk of stroke among 3134 individuals with history of cerebrovasculary disease. Stroke. 35:622-626.

Bath PM, Butterworth RJ (1996). Platelet size, measurement physiology and vascular disease. Blood Coagul Fibrinolysis. 7 (2): 157-161.

Becchi C, Al Malyan M, Fabbri LP, Marsili M, Boddi V, Boncinelli S (2006). Mean platelet volume trend in sepsis: is it a useful parameter? Minerva Anestesiol. 72(9):749-756.

Cameron HP, Ibbotson RM, Carson PHM (1983). Platelet size in myocardial infarction. Br. Med. J. 287: 449-551.

Chung I, Choudhury A, Lip GY (2007). Platelet activation in acute decompansated congestive heart failure. Thomb. Res. 120(5):709-713.

Coban E, Adanir H (2008). Platelet activation in patients with Familial Mediterranean Fever. Platelets. 19(6):405-408.

Corash L, Tan H, Grolnick HR. (1977). Heterogeneity of human whole blood platellet subpopulation. I. Relationship between buoyant density, cell volume and ultrastructure. Blood. 49: 71-87.

Endler G, Klimesch A, Saunder- Plasman A (2002). Mean platelet volume is an independent risk factor for myocardial infarction but not for coronary artery diseases. Br.J. Haemtol.117: 399-404.

Erikçi AA, Muhçu M, Dündar O, Oztürk A (2008). Could mean platelet volume be a predictive marker for gestational diabetes mellitus? Hematol.13:46-48.

Hekimsoy Z, Payzin B, Ornek T, Kando an G (2004). Mean platelet volume in Type 2 diabetic patients. J Diabetes Complications. 18:173-176

Huczek Z, Kochman J, Filipiak KJ (2005). Mean platelet volume on admission predicts ımpaired reperfusion and long-term mortality in acute myocardial infarction treated with primary percutaneous coronary intervention. J. Am. Coll. Cardiol. 46; 284-290.

Greisenegger S, Endler G, Hsieh H, Tentschert S, Mannhalter C, Lalouschek W (2004). Is elevated mean platelet volume associated with a worse outcome in patients with acute ischemic cerebrovascular events? Stroke. 35: 1688-91.

Jagroop IA, Mikhailidis DP (2003). Mean platelet volume as an independent risk factor for myocardial infarction but not for coronary artery disease. Br. J. Haematol. 120: 169-170.

Kisacik B, Tufan A, Kalyoncu U, Karadag O, Akdogan A, Ozturk MA, Kiraz S, Ertenli I, Calguneri M (2008). Mean platelet volume (MPV) as an inflammatory marker in ankylosing spondylitis and rheumatoid arthritis. Joint Bone Spine. 75(3):291-4.

Knaus WA, Draper EA, Wagner DP, Zimmerman JE (1985). "APACHE II: a severity of disease classification system". Crit.Care Med. 13: 818–829.

Lelie JV, Borne AKV (1983). Increased mean platelet volume in septicaemia. J Clin Pathol. 36:693-696.

Nair S, Kulkarni S, Camoens HM (2001).Changes in platelet glycoprotein receptors after smoking- a flow cytometric study. Platelets. 12:20-26.

Nalbant S, Cagiltay E, Terekeci MH, Kaplan M, Sahan B, Sayan B, Oktenli C (2009). Prognostic value of mean platelet volume in patients with upper gastrointestinal bleeding.Eur. J. Med. 4:208-211.

Nadar SK, Blann AD; Kamath S (2004). Platelet indexes in relation to target organ damage in high risk hypertensive patients: A substudy of the ASCOT. J. Am. Coll. Cardiol. 44:415-22.

Pabon P, Nieto F, Morinigo JL (1998). The effect of mean platelet volume on the short term prognosis of the acute myocardial infarction. Rev. Esp. Cardiol.51: 816-22.

Pizzuli L, Yang A, Martin JF, Luderitz B (1998). Changes in platelet size and count in unstable angina compared to stable or non-cardiac chest pain. Eur. Heart J. 19:80-4.

Thompson CB, Eaton KA, Princiotta SM (1982). Size-dependent platelet subpopulation: relationship of platelet volume to ultrastructure,enzymatic activity and function. Br. J. Haematol.50: 509-520.

Yilmaz Z, Eralp O, Ilcol YO (2008). Evaluation of platelet count and its association with plateletcrit, mean platelet volume, and platelet size distribution width in a canine model of endotoxemia. Vet. Clin. Pathol.37(2):159-163.