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ORIGINAL ARTICLE

Correlation Between Platelet Counts and MPV Values with Mortality Rates in Acute Ischemic Stroke Patients

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Abstract

The purpose of this study was to determine the relationship of platelet counts and MPV values with mortality rates in patients with acute ischemic stroke. The sample used for this study was ischemic stroke patients at RSUP Dr. M. Djamil Padang as many as 66 samples consisting of 33 live patients and 33 patients died. Data were analyzed using independent t-test. The mean platelet count in patients with acute ischemic stroke who died was significantly ($p < 0.05$) lower with 233,52 ± 71.1 / mm^3 compared to those who survived with 301,58 ± 85.6 / mm^3. The mean MPV value in patients with acute ischemic stroke who died was significantly ($p < 0.05$) higher with 9.91 ± 1.7 fL than those who survived (7.73 ± 0.7 fL). There was a positive correlation between platelet counts and MPV values ($r = 0.32$; $p = 0.008$) with mortality rates in acute ischemic stroke patients.

Keywords: Platelet counts, MPV value, acute ischemic stroke

Introduction

According to WHO (2018), in 2016 stroke was ranked as the second leading cause of death worldwide after ischemic heart disease. There were 15.2 million deaths worldwide due to ischemic heart attacks and strokes (Bianca et al., 2012). In Indonesia, according to Ministry of Health data on Basic Health Research in 2018, the prevalence of stroke rose from 7% (Riskesdas 2013) to 10.9% (Ministry of Health Republic of Indonesia, 2018). Dr. M. Djamil Padang is one of the referral hospitals in West Sumatra which handles stroke cases. The number of ischemic stroke patients hospitalized in 2014 were 206 patients with 112 male patients and 94 female patients. Meanwhile, the number of ischemic stroke patients who were hospitalized in 2015 at RSUP Dr. M. Djamil Padang were 206 patients with 120 male patients and 86 female patients.

Broadly, strokes are classified into ischemic strokes which can be found in 80-85% of stroke cases, as well as hemorrhagic strokes that can be found in 15-20% of stroke cases

(Goldman, 2012). Determination of the diagnosis of ischemic or hemorrhagic stroke can be done by examining the Head CT Scan which is a gold standard examination for strokes (Gofir, Mianoki, & Nuradyo, 2017).

Thrombosis is a major complication of the atherosclerosis process which involves activation and aggregation of platelets that develop from ulceration of atheromic plaque. Atherothrombosis triggers local occlusion and embolism in the distal region with clinical manifestations that can be seen in ischemic stroke (Shah, Mir, Kamili, Bardi, & Masoodi, 2013). Platelet count and Mean Platelet Volume (MPV) are available at each complete blood cell examination. MPV is the average volume (size) of platelets, increasing in patients with myocardial infarction and cerebrovascular disease (Berger, Eraso, Xie, Sha, & Mohler, 2010). Ghahremanfard (2013) in his study explaining that platelet volume is associated with shorter bleeding times and MPV has been thought to be related to the severity of ischemic stroke (Ghahremanfard et al., 2013). MPV has an important role in hemostasis as the body's mechanism to stop spontaneous bleeding by forming and stabilizing platelet plugs. MPV can be used as a marker of platelet activation, because large platelets are more reactive, produce more protrombic factors and more easily aggregate (Arévalo-Lorido et al., 2013). Formation of platelet plugs occurs through several stages, namely platelet adhesion, platelet secretion, platelet aggregation and platelet procoagulant activity (Naidech et al., 2014).

Prognosis of stroke can be seen from the aspect of death. The 30-day case mortality rate is substantially higher in patients with cerebral hemorrhage (63.3%) and subarachnoid hemorrhage (58.6%) compared to patients with cerebral infarction (9.0%) (Jaya, 2018). Based on research conducted by Elsayed and Mohamed (2017), it was explained that MPV levels in ischemic stroke patients showed a significant increase compared to controls. Du et al (2016) study showed that MPV levels in ischemic and hemorrhagic stroke patients were significantly higher than controls, and platelet counts showed a positive correlation with the risk of ischemic stroke. Similarly, research by Arikanogulu et al. found that MPV and CRP were higher in ischemic stroke patients who died than in survivors, where these MPV and CRP might be indicate the death in stroke patients compared to patients who survived (Arikanoglu et al., 2013). Most strokes are caused by thrombus in the blood vessels or heart where the MPV plays a role in function and reactivity from platelets, so it is hoped that MPV values can be used as predictors of mortality related to vascular disease.

Research about the relationship between platelet count and mean platelet volume (MPV) with mortality rates in acute ischemic stroke patients is a good prospect in the future because of the high mortality rate due to acute ischemic stroke. This is a research urgency, where it is expected that the results of research on platelet and MPV numbers can be predictors of mortality, so they can reduce the risk of death for patients with acute ischemic stroke.

Materials and Methods

Research Design

This study used an analytic observational research design with cross sectional approach. This research was conducted in the Medical Record and Inpatient Unit of the Neurosurgery Dr. M. Djamil Padang from March to August 2019.

Sampling Method

Sampling method using medical record data in 2018 by consecutive sampling techniques. The sample used for this study was acute ischemic stroke patients at RSUP Dr. M. Djamil Padang. The total sample of 66 samples consisted of 33 live patients and 33 patients died.

The inclusion criteria in this study were: 1) Patients who suffered a first stroke and were diagnosed with ischemic stroke as evidenced by the results of the CT scan; 2) Patients with stroke

without complications. The exclusion criteria were: 1) Recurrent stroke patients; 2) Patients have a history of malignancy; 3) Patients receive thrombolytic or anticoagulant therapy before examining platelet counts and MPV; 4) Patients with a history of fever before a stroke, HIV infection, malaria and dengue fever; 5) Patients who do not have complete data on medical records.

Statistical Analysis

Comparison of platelet counts and MPV values in ischemic stroke patients using an independent T-test. Analysis of the normality data used the Kolmogorov-Smirnof test, and the research data test used a correlation test to determine whether there was a relationship between the number of platelets and MPV with the mortality rate in patients with acute ischemic stroke.

Results

Based on the research, the following results were obtained:

Table 1. Comparison of mean platelet counts and MPV values in patients with acute ischemic stroke

Variable	Acute Ischemic Stroke Patients		p value
	Living	Died	
Platelet counts (mm^3)	301.58±85.6	233.52±71.1	0.00
MPV value (fL)	7.73±0.7	9.91±1.7	0.00

The mean platelet count in patients with acute ischemic stroke who died was significantly lower with (233,52 ± 71.1 / mm3) ($p < 0.05$) compared to those who survived with (301,58 ± 85.6 / mm3). The mean MPV value in patients with acute ischemic stroke who died was significantly higher (9.91 ± 1.7 fL) ($p < 0.05$) than those who survived with (7.73 ± 0.7 fL). There is a positive correlation between platelet counts and MPV values ($r = 0.32$; $p = 0.008$) with mortality rates in patients with acute ischemic stroke.

Discussion

The relationship between MPV values in thrombosis and inflammation events has been very interesting in recent decades and several studies have reported significant high MPV values in acute phase thrombotic stroke patients (Kuncoro, 2017). MPV values associated with platelet activation and is a marker of hemostasis. Larger platelets are easier to clot and are more metabolically active than smaller platelets. Increased MPV values triggered an increase in the secretion of thromboxane protrombotic agents A2, serotonin, β-thromboglobulin, P-selectin and glycoprotein-IIIA (Arikanoglu et al., 2013).

Several studies that measure platelet volume in acute ischemic stroke have shown inconsistent results, and also an increase in platelet aggregation in acute phase strokes is still debated. (Baburhan, et al., 2008) compared MPV values and platelet counts in 102 acute ischemic stroke patients with healthy controls and did not get a significant difference. Ntaios, et al., (2010), also showed that there was no relationship between MPV values in the initial phase of acute ischemic stroke, and the severity and prognosis of stroke (Ntaios, et al., 2010).

In this study, we found higher platelet counts in living patients than in patients who died. Platelets were nucleatid cells that have an important role in the pathogenesis of atherothrombosis.

Platelets cause thrombus formation and also play a role in the inflammatory process. Activated platelets are larger than normal size (Ren et al., 2017)

Arikanoglu et al., (2013) showed higher MPV values in acute ischemic stroke patients compared with control group. In addition, the MPV value in patients who died in the first 10 days was significantly higher than in patients who lived. Mayda et al, (2010) concluded that the increase in the value of MPV is a predictor of prognosis and the value of MPV is a marker of increased platelet reactivity. Kuncoro (2017) found a significant difference between patients with high MPV values with moderate / severe The National Institutes of Health Stroke Scale (NIHSS) scores with a probability of 7 times greater than patients with low MPV levels with mild NIHSS scores, it means that there is a relationship between increasing MPV values with the severity of stroke and that MPV can be used as a predictor to predict the severity of acute-phase ischemic stroke patients. This is consistent with the results of the study Ghahremanfard et al. (2013), MPV levels in the first 24 hours after the onset of a stroke have a strong relationship with the severity of the disease and effectively distinguish it from severe and mild severity. Increased MPV is associated with poor outcome of patients in acute-phase ischemic stroke.

MPV can be used to show changes in the level of platelet stimulation and its function and it is very important to assess various clinical conditions. In vascular disorders, the severity and duration of the disease are associated with stimulation of platelet production and MPV has a large role in detecting and monitoring this disorder (Ghahremanfard et al., 2013). Platelet count and MPV values are inversely proportional; if MPV increases, the platelet count decreases (Arikanoglu et al., 2013). Increased MPV values in ischemic stroke patients who die compared to patients who live in this study show the role of MPV in the pathogenesis and mortality in stroke.

Conclusion

Patient who died showed lower platelet count and higher MPV compared with those who survived. This suggests that these variables can be used as predictors for the follow-up and prognosis of stroke patients. Correlation of platelet counts and MPV values can be an indication that platelet counts and MPV values play a role in the mortality of stroke patients.

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