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Oral Presentation
THE 1ST SYEDZA SAINTIKA INTERNATIONAL CONFERENCE ON NURSING, MIDWIFERY, MEDICAL LABORATORY TECHNOLOGY, PUBLIC HEALTH, AND HEALTH INFORMATION MANAGEMENT (SeSICNiMPH)

DIFFERENCES OF HEMOGLOBIN LEVEL, HEMATOCRITE VALUE AND THE NUMBER OF ERYTHROCYTE IN ISCHEMIC AND HEMORRHAGIC STROKE AT M. HATTA BRAIN HOSPITAL

Annita [1*], Deswita [2]
[1]SyedzaSaintika's Health Science Institute
[2]RS Otak M. Hatta

*Corresponding author. Email: annitat66@gmail.com

ABSTRACT

Stroke is the main cause of physical disability in productive age and elderly. Blood viscosity/ viscosity in stroke patients can be seen based on the results of blood hematology examinations in the form of an increase in hemoglobin levels, hematocrit values and the number of erythrocytes from normal values carried out in the laboratory. Assessing blood viscosity / blood viscosity helps stroke management to reduce the spread of damage to brain cells in stroke survivors. This study aimed to compare levels of hemoglobin levels, hematocrit values and the number of erythrocytes in ischemic stroke and hemorrhagic stroke. The research design was cross sectional study. This research was conducted on 60 subjects (30 patients with ischemic stroke and 30 patients with hemorrhagic stroke) who are IGD patient in M. Hatta Brain Hospital from March to August 2020. Hemoglobin levels, hematocrit values and erythrocyte count were examined using the Hematology Analyzer. Comparison of hemoglobin levels, hematocrit values and the number of erythrocyte in ischemic and hemorrhagic stroke patients using an independent T-test, $p < 0,05$ was considered significant. The mean rates of hemoglobin levels, hematocrit values and the number of erythrocytes were lower inischemic stroke ($12,6 \pm 1,1$/ gr/dl; $38 \pm 2,9$/ %; $4,3 \pm 0,4$/ million/mm^3) than in hemorrhagic stroke ($15,2 \pm 0,1$/ gr/dl; $45 \pm 2,7$/ %; $5,1 \pm 0,4$/ million/mm^3). There were significant differences in hemoglobin levels, hematocrit values and the number of erythrocytes in ischemic stroke and hemorrhagic stroke.

Keywords: Blood viscosity, hemostasis, blood component, stroke disease, hypertension

INTRODUCTION

Stroke is the main cause of physical disability in productive age and elderly. In developed countries, stroke is the number one cause of patient admission to hospital, with a proportion of death as much as 20% within the first 28 days of treatment (Panella et al., 2012). According to the World Stroke Organization, 1 in 6 people in the world will experience a stroke in their lifetime, while data from the American Health Association (AHA) states that every 40 seconds there is 1 new case of stroke with a prevalence of 795,000 new or recurring stroke patients every year and approximately approximately every 4 minutes there is 1 stroke patient dies (Roger et al., 2011). Based on Riskesdas 2018, the prevalence of stroke based on diagnosis in

people aged ≥15 years has increased from 11.1 to 14.7, where West Sumatra Province itself ranks in the top 15 in all of Indonesia. In the last 5 years in West Sumatra, the number of stroke sufferers has increased 4 times.

Based on the nature of the cerebral lesions, stroke is divided into 2, namely ischemic stroke and hemorrhagic stroke (Suroto, 2002). Ischemic stroke is the most common type of stroke, representing more than 80% of all stroke cases, 10-15% of hemorrhagic stroke and the remaining 5% bleeding around the brain (Annita et al., 2019). The biggest risk factors for stroke are smoking, hypertension, hypercholesterolemia, diabetes mellitus, high number of erythrocyte cells, blood vessel disorders, obesity (obesity),

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lack of physical activity / sports, drinking alcohol (Cinnar et al., 1999; Junaidi, 2011; Ardhilla et al, 2012).

Blood viscosity / viscosity in stroke patients can be seen based on the results of blood hematology examinations in the form of an increase in hemoglobin levels, hematocrit values and the number of erythrocytes from normal values carried out in the laboratory (Setiabudy, 2012; Cinar et al., 1999). One of the things that is thought to be involved in the oxygenation process of the brain in addition to blockages in brain blood vessels is the condition of hemoglobin levels in stroke patients (Thijs et al., 2000). The lower the Hb level, the greater the clinical degree score, so the worse the patient's clinical condition (Tutwuri et al., 2014). Hemoglobin level also correlates with poor clinical grade of neuroimaging features. This underlies that a low Hb condition is associated with an increased mortality rate (Tanne, et al, 2010).

Changes in hemostasis or blood viscosity due to various reasons such as an increase in hematocrit can increase the likelihood of a stroke (Junaidi, 2011). The higher the percentage of hematocrit means that the blood concentration is thicker which can lead to hypovolemic shock (Sutedjo, 2009). High hematocrit levels cause an increase in blood viscosity which results in decreased blood flow in the brain. Although the increase in blood viscosity is not only caused by an increase in hematocrit, if the hematocrit level exceeds 46%, the blood viscosity will increase sharply (Widijatno et al., 2006).

The increased hematocrit is caused by the formation of too many red blood cells or erythrocytosis. The reduced oxygen delivery will trigger the formation of red blood cells resulting in an increase in the hematocrit. This results in an increase in oxygen levels. Increased oxygen levels are not accompanied by proper delivery. Oxygen delivery throughout the body, especially the brain,

remains disrupted due to increased blood viscosity. The blood vessels that are already small will become smaller. This causes the burden on the heart to also increase, so the blood pressure will also increase (Leonardo, et al., 2008).

In a study conducted by Cinar, et al (1999) in their study of the effect of hematocrit on blood pressure through hyperviscosity, it showed that an increase in hematocrit of about 10.99% would increase blood viscosity by ± 20%. This increase in blood viscosity will result in a decrease in blood flow of 16.67%. This reduction in blood flow will cause a compensatory mechanism in which blood pressure will increase approximately 20% of normal. An increase in blood pressure will cause an increase in circulatory load and this will result in an increased risk of ischemia.

Blood viscosity / viscosity is not new to the medical community, but there are still few medical personnel who are aware that blood viscosity is found in stroke patients. Assessing blood viscosity / blood viscosity helps stroke management to reduce the spread of damage to brain cells in stroke survivors. Based on this background, researchers are interested in conducting research on differences in hemoglobin levels, hematocrit values and erythrocyte counts in ischemic stroke and hemorrhagic stroke patients at M. Hatta Brain Hospital.

MATERIAL AND METHODS

This study used an analytic observational research design with cross sectional approach. This research was conducted on 60 subjects (30 patients with ischemic stroke and 30 patients with hemorrhagic stroke) who are IGD patient in M. Hatta Brain Hospital from March to August 2020.

The inclusion criteria in this study were: 1) Patients who suffered a first stroke and were diagnosed with ischemic and hemorrhagic stroke as evidenced by the

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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 with a history of fever before a stroke, HIV infection, malaria and dengue fever; 4) Patients who do not have complete data on medical records.

Hemoglobin levels, hematocrit values and erythrocyte count were examined using the Hematology Analyzer. Comparison of hemoglobin levels, hematocrit values and erythrocyte count in ischemic and hemorrhagic stroke patients using an independent T-test.

RESULTS

Based on the research, the following results were obtained:

Table 1. Comparison of mean hemoglobin levels, hematocrit values and erythrocyte counts in ischemic and hemorrhagic stroke patients

Variable	Ischemic Stroke	Hemorrhagic Stroke	P-value	N
Hemoglobin levels (gr/dl)	12,6±1,1	15,2±0,1	.000	60
Hematocrit values (%)	38±2,9	45±2,7	.000	60
Erythrocytes counts (million/mm^3)	4,3±0,4	5,1±0,4	.000	60

The mean hemoglobin levels in ischemic stroke patients was significantly lower with (12,6±1,1/ gr/dl) (p <0.05) compared to hemorrhagic stroke patients with (15,2±0,1/ gr/dl). The mean hematocrit values in ischemic stroke patients was significantly lower with (38±2,9/ %) (p <0.05) compared to hemorrhagic stroke patients with (45±2,7/ %).The mean erythrocytes counts in ischemic stroke patients was significantly lower with (4,3±0,4/ million/mm^3) (p <0.05) compared to hemorrhagic stroke patients with (5,1±0,4/ million/mm^3). There are different hemoglobin levels, hematocrit values and erythrocyte counts in ischemic and hemorrhagic stroke patients.

DISCUSSION

There are several factors that cause people to be more prone to or prone to stroke, including hypertension, stress, smoking, heart disease and diabetes mellitus. The risk factor is in the form of hypertension, this is reinforced by the fact in the field at the time of the study, hemorrhagic stroke patients had higher blood pressure than the blood pressure of ischemic stroke patients.

Low or high hemoglobin levels are associated with a high risk of stroke. Low hemoglobin levels in stroke patients are related to the extent of the infarct area and the increase in infarct area, along with other factors such as age, gender, blood glucose levels and stroke subtype.

The wider the area of the brain that is infarcted, the worse the clinical symptoms appear (Kimberly et al, 2011). Low hemoglobin levels are not the only cause of poor neurological status in stroke patients. There are several other factors that also affect the poor neurological status of stroke patients such as age, gender, glucose and hematocrit levels at admission, and levels of leukocytes. Some patients with high hemoglobin levels also have poor neurological status.

Hematocrit value is a minor risk factor for stroke patients. Low hematocrit levels are caused by various reasons, such as aging, chronic kidney failure, heart disease (acute coronary syndrome), malignancy and others. Decreased hematocrit can cause stroke, which

is associated with acute coronary syndrome, which is a risk factor for stroke, which means that decreased hematocrit is more related to expansion of infarction. In stroke patients with normal hematocrit values, major risk factors dominate the occurrence of stroke (Hutajulu, 2015). This is in accordance with the research conducted by Kiyohara, et al, where in their research it was stated that normal hematocrit was due to a minor risk factor.

Low erythrocyte count is associated with stroke. This is in accordance with the research of Tandu et al., 2018. Based on his research at the time of stroke, a decrease in work on molecules and tissues in the body begins. A variety of factors including a decrease in the number of erythrocytes contribute to the prognosis of arteries in stroke patients. The number of erythrocytes below normal values causes resistance in stroke patients and causes disruption of oxygen transport to other organs which can lead to a number of organ failure and death.

CONCLUSION

Ischemic stroke patients showed lower hemoglobin levels, hematocrit values and erythrocyte counts compared with hemorrhagic stroke patients. There are different hemoglobin levels, hematocrit values and erythrocyte counts in ischemic and hemorrhagic stroke patients.

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