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Increased Neutrophil Count Related to Bleeding Volume in Intracerebral Hemorrhage Cerebrovascular Accident

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Abstract

Background: Cerebrovascular accidents (CVA) were increasing per year. In Indonesia, it has reached 550.000 cases per year. Ten to fifteen percent are types of CVA bleeding (CVA-B). Death and disability as complications of CVA-B are more often compared to an ischemic type. Early diagnosis of CVA-B is critical to decreasing its complications. Unfortunately, diagnosis of early CVA-B requires excellent effort and spending more expense when using an advanced CT scan. Previous research has shown a relationship between leucocyte count and CVA, but there is no adequate data relating leukocyte count and mean arterial pressure (MAP) with bleeding volume in CVA-B patients.

Objective: To answer whether leukocyte counts combined with MAP can be a choice to diagnose CVA-B at an early stage.

Methods: Analytic observational research was conducted with a cross-sectional approach. The population of this study was all patients with CVA intracerebral bleeding at Ulin Hospital of Banjarmasin. The patient's medical records and CT scans were used to assess the bleeding volume. The number of leukocytes and the patient's mean arterial pressure were tabulated and analyzed according to their relationship with bleeding volume.

Results: In this study, there was a significant relationship between the number of leukocytes and the volume of intracerebral hemorrhage (r=0.801, p=0.000). There was no significant relationship between the MAP and the volume of intracerebral hemorrhage (r=0,17, p=0,361)

Conclusion: There is a strong and significant relationship between the number of leukocytes and the volume of bleeding in patients with intracerebral hemorrhage but no relationship with MAP.

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INTRODUCTION

Intracerebral hemorrhagic cerebrovascular accidents (CVA) was defined by the American Heart Association / American Association (AHA/ASA) as a clinical symptom of rapidly developing neurological dysfunction caused by a focal collection of blood in the brain parenchyma or ventricular system that is not caused by trauma. The incidence of CVA in Indonesia reaches 300,000 per year, 20 percent of total death cases. Ten to fifteen percent are hemorrhagic cerebrovascular accidents. The mortality and morbidity of hemorrhagic CVA are more severe than that of ischemic CVA. It is reported that only about 20% of patients with hemorrhagic CVA regain their motoric function. About 40-80% eventually die in the first 30 days after the attack, and about 50% die in the first 48 hours. The study showed that of 251 CVA cases, 47% were women and 53% were men, with an average age of 69 (78% over 60). Male patients older than 75 and the male gender showed a worse outcome. In Indonesia, according to RISKESDAS, the prevalence of CVA has increased from 8.3‰ in 2007 to 12.1‰ in 2013. The highest prevalence of CVA based on diagnosis by health workers is in South Sulawesi (17.9‰), Yogyakarta (16.9‰), and Central Sulawesi (16.6‰). In Kalimantan, the highest prevalence of CVA is in South Kalimantan (14.5‰), followed by Central Kalimantan (12.1‰), East Kalimantan (10‰), and West Kalimantan (8.3‰).[1, 2,8]

CT scan is the first examination performed to evaluate CVA, especially in the acute phase in the emergency room. CT scan is the gold-standard diagnosis for patients with hemorrhagic and ischemic cerebrovascular accidents. CT scans were used to detect the presence of intracranial hemorrhage, stroke occupying lesion (SOL), cerebral edema, and changes in brain structure. However, due to limited facilities and costs, CT scans cannot always be performed on all cerebrovascular accident patients.[2]

Leukocytes have long been used to help diagnose various diseases that occur in humans. An increase in leukocytes is used as a supporting diagnostic tool in various types of infectious diseases, including to help establish the type of cerebrovascular accidents. Blood and plasma products mediate various secondary processes after intracerebral hemorrhage cerebrovascular accidents. Bestue-Cardiel et al. also stated that there was a significant relationship between the volume of intracerebral hemorrhage and the number of leukocytes in intracerebral hemorrhage cerebrovascular accidents.[2.3]

Mean arterial pressure after intracerebral hemor-rhage is associated with hematoma expansion, cerebral edema, increased intracranial pressure, and early neurologic damage. Factors associated with a poor outcome occur when bleeding into the brain parenchyma is of considerable size, decreased consciousness, increased mean arterial pressure, dilated intraventricular hemorrhage, and older age.[4]

Previous studies have shown an association between increased leukocytes in hemorrhagic cerebrovascular accidents. However, there has never been a study linking leukocyte count and mean arterial pressure with bleeding volume in patients with intracerebral bleeding cerebrovascular accidents at Ulin Hospital of Banjarmasin. Therefore, the researcher wanted to examine the relationship between leukocyte count and mean arterial pressure with bleeding

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volume in patients with intracerebral hemorrhage cerebrovascular accidents.

METHODS

This research is an analytic observational study with a cross-sectional approach. The population of this study was all CVA patients due to intracerebral hemorrhage at Ulin Hospital Banjarmasin. The research was carried out after obtaining approval from the Research Ethics Committee of the Faculty of Medicine, Lambung Mangkurat University, with letter number 1038/KEPK-FKUNLAM/EC/XI/ 2018. Amount sample with the purposive sampling method as much as 30 respondents.[1,6]

The sample inclusion criteria was a patient diagnosed with intracerebral hemorrhagic cerebrovascular accident by a neurologist, and the patient agreed to be included in the study. Sample exclusion criteria are patients with infection, patients with coagulation disorders, and patients with intraventricular hemorrhage. The research instruments that will be used are the results of a head CT scan, the results of laboratory examinations, and the results of medical records to determine blood pressure. The data collected is secondary data obtained from medical records and the results of a CT scan of the patient's head. The secondary data were the bleeding volume, the number of leukocytes, and the patient's mean arterial pressure. The data are tabulated and calculated—the normality distribution of bleeding volume data is tested with the Kolmogorov-Smirnov test. If the data is normally distributed and homogeneous, continue with Pearson's test with a level of 95% confidence. If the data is not normally distributed, it will conduct data transformation. If, after transformation, data become distributed normally, then next to the Pearson test.[17]

RESULTS

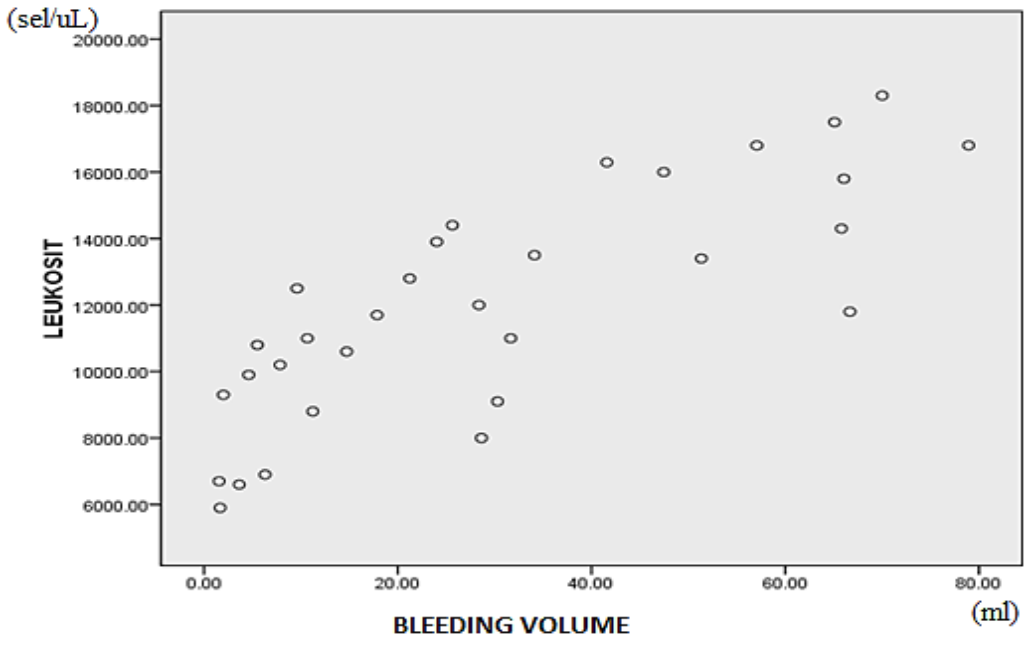

Figure 1. Relation between Leucocyte Count and Bleeding Volume

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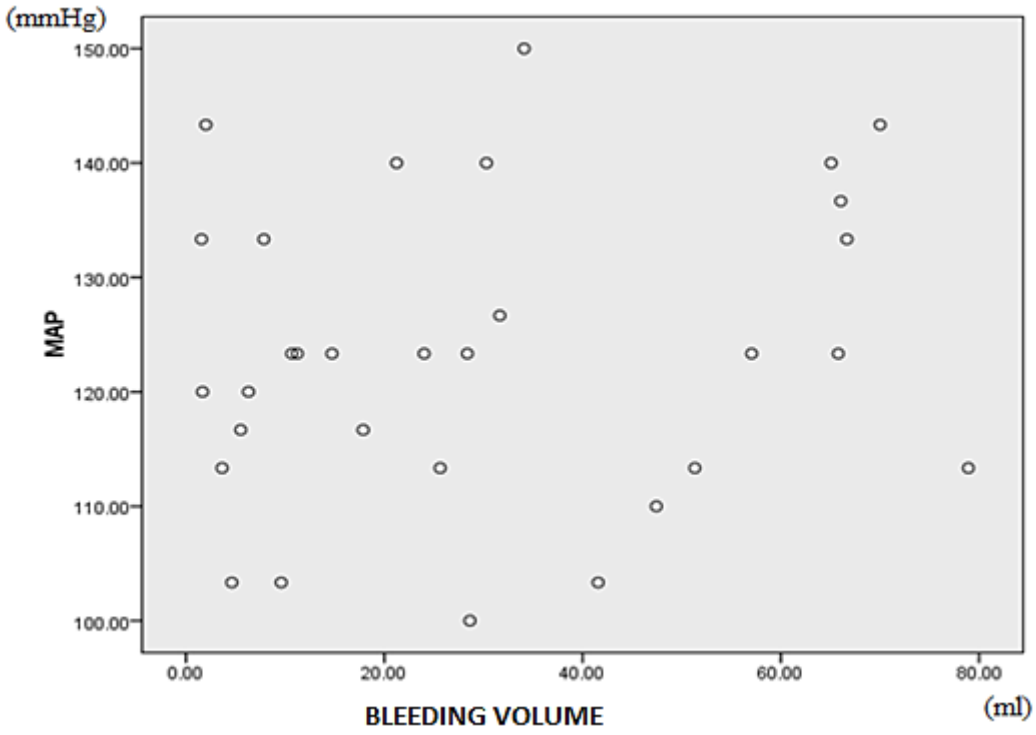

Figure 2. Relation between MAP and Bleeding Volume

The increased bleeding volume related to the patient's leukocyte examination also tends to increase, as shown in Figure 1. This study had a significant relationship between the number of leukocytes and the volume of intracerebral hemorrhage (r=0.801, p=0.000).

Several studies that have been conducted previously also obtained a significant relationship between the two variables. An example is the research conducted by Hatta et al. and Suzuki et al. each of these studies obtained a corre-lation value of r=0.939 (p= 0.001) and r=0.050 (p<0.001).[6,18]

Conversely, MAP was unrelated to its bleeding volume, as shown in Figure 2. This study had no significant relationship between the MAP and the volume of intracerebral hemorrhage (r= 0,17, p=0,361).

DISCUSSION

Violi et al. [19] conducted a study to assess leukocyte activation in patients with ischemic CVA and hemorrhagic CVA, which was conducted with a sample of 40 ischemic CVA patients and 12 hemorrhagic CVA patients. The study evaluated leukocyte activation using plasma oxidant activity. This study found that the oxidant activity, which indicates leukocyte activation, was significantly increased in ischemic CVA and hemorrhagic CVA patients compared to the control group (healthy group). This study concludes that leukocyte activation occurs in patients with ischemic CVA and hemorrhagic CVA.[19]

Peripheral leukocytes are a marker of the immune system's activation and reflect the activation of the inflammatory cascade after intracerebral hemorrhage. The theory states that

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various immune system components will appear, including leukocytes, neutrophils, macrophages, active microglia, proinflammatory cytokines, and complement components, so that they can induce inflammatory reactions in hematomas in the surrounding area.[21] Tumor necrosis factor (TNF), interleukin, monocyte granulocyte colony-stimulating factor (GM-CSF), and several other components will also be released in the brain in CVA-B to brain injury and act as a trigger factor for leukocyte production.[22,23]. This factor is also a reasonably strong feedback mechanism that starts with tissue inflammation and then continues to form large numbers of leukocytes that help eliminate the cause of the inflammation.[22] Some researchers concluded that there is a significant relationship between the number of leukocytes and the bleeding volume in intracerebral hemorrhagic CVA.[3,6,18] Although several studies have shown a relationship between the number of leukocytes and the volume of intracerebral hemorrhage until now, the number of leukocytes has not been used as a parameter to assess the volume of bleeding. Due to confounding factors that affect the relationship between the number of leukocytes and the volume of intracerebral hemorrhages, such as infection, blood disorders, and others that affect the number of leukocytes.[24]

CONCLUSION

This research has proven a strong and significant relationship between leukocyte count and bleeding volume in patients with intracerebral hemorrhage, and there is no relationship between mean arterial pressure and bleeding volume in patients with intracerebral hemorrhage. Thus, one alternative way to predict the volume of bleeding in CVA patients with intracerebral hemorrhage is to look at the patient's leukocyte examination results if a CT scan cannot be done immediately. Hence, immediate treatment can be done based on this result to reduce the neurological deficits in patients.

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