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In-Hospital Complications are Associated with Prolonged Length of Stay in Acute Ischemic Stroke Patients

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Abstract

Background and Objective: Stroke is an economic and health burden for patients, society, and health services; and one is the length of stay hospitalization. Ischemic stroke patients with hospitalization <7 days indicate the quality of hospital stroke services. This study aimed to compare the clinical characteristics of ischemic stroke patients during hospitalization at Dr. Hasan Sadikin Hospital Bandung, Indonesia.
Subject and Method: This study was cross-sectional, with a sample research subjects of all ischemic stroke patients from January to April 2023 at Dr. Hasan Sadikin General Hospital Bandung, Indonesia were divided into 2 groups, namely the ≤ 7 days and the > 7 days group. The indicators characteristics were age, onset, National Institute of Health of Stroke Scale (NIHSS), Neutrophyl-to-Lymphocyte Ratio (NLR), and complications obtained through medical records. Statistical analysis was calculated using the Mann-Whitney and Fisher correlation tests.
Results: A total of 59 subjects, there are no significance difference ($p>0.05$) on variables of age (median 58 vs 63 years), onset (median 11 vs 7 hours), NIHSS (median 6 vs 8), and NLR (median 3.22 vs 4.41). In-hospital complications such as infection and hyponatremia, was significantly different between two groups ($p<0.05$).
Conclusion: In-hospital complications are associated with prolonged length of stay in patients with acute ischemic stroke. This can be the basis for developing strategies to increase the indicators management of stroke services by reducing the complication ischemic stroke during hospitalization.

Keywords: In-hospital complication, ischemic stroke, length of stay

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Introduction

Stroke was the second most common cause of death and the third most common cause of disability worldwide. It is estimated that approximately one in six individuals will have a stroke during their lifetime. In 2016, there were 13.7 million new cases of stroke globally, with 87% of these cases being ischemic strokes.[1] In Indonesia, the 2018 basic health research (Riset Kesehatan dasar, Riskesdas) data showed an increase in the incidence of stroke events to 10.9/1000 people when compared to 2013 data which amounted to 7 /1,000 people.[2] Compared to other countries in Southeast Asia, Indonesia has the highest mortality rate based on age and sex (193.3/100,000) and also on the disability rate (3,382.2/100,000).[3] Stroke is a heavy economic and health burden for patients, communities and health services in the world, including the duration of hospitalization, long-term disability and death, especially in low- and middle-income countries. According to the National Health Insurance, the health care costs for stroke continue to rise every year, namely 1.43 trillion rupiah in 2016, then 2.19 trillion rupiah in 2017, and reached 2.57 trillion rupiah in 2018.[3,4] Shorter duration of hospitalization helps reduce hospital costs,

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increases optimization and efficiency of hospital capacity, and reduces the number of complications that can make stroke patient outcomes worse, and will affect the quality of services for ischemic stroke patients. Quality stroke service during hospitalization applied to all government referral hospitals, including at Dr. Hasan Sadikin General Hospital Bandung, and according to the clinical pathway in effect at Dr. Hasan Sadikin General Hospital, Bandung, the maximum length of treatment for ischemic stroke patients is 7 days.[5,6] This condition makes maps and descriptions of the duration of hospitalization in ischemic stroke patients important for analysis. By studying more deeply the factors that contribute to the length of stay in ischemic stroke patients, it is hoped that it can provide better care to reduce the duration of treatment so that it can achieve the treatment target of <7 days, and as a reference for assessing the quality and efficiency of ischemic stroke services in hospitals, especially in West Java.[6] This study was aimed to assess the comparison of clinical characteristics of ischemic stroke patients treated < 7 days and > 7 days at Dr. Hasan Sadikin General Hospital Bandung.

Methods

This study used an analytical cross-sectional design to compare clinical characteristics between patients with hospital stay ≤7 days and >7 days. The Subjects in this study used a total sampling technique of 59 ischemic stroke patients who were treated in January 2023 - April 2023 at Dr. Hasan Sadikin General Hospital Bandung were divided into 2 groups, namely the ≤ 7 days and the >7 days group, with the exclusion criteria being death status. The variables used in this study were age, sex, onset, NIHSS, neutrophil lymphocyte ratio (NLR), and stroke complications such as infection and hyponatremia of patients obtained through medical records. The collected data was recorded in Excel form and analyzed using SPSS 25.0 series. Statistical analysis of patients was calculated using the Mann-Whitney and Fisher correlation tests. The study was carried out following the acquisition of ethical approval from the research ethics committee of RSUP Dr. Hasan Sadikin Bandung (LB.02.01/X.6.5/313/2023). The study adhered to all applicable ethical guidelines, including the Declaration of Helsinki. Every participant provided written informed consent prior to their involvement in the study.

Results

Of the 59 subjects, they were divided into 2 groups, namely the treatment group ≤ 7 days, and the treatment group > 7 days. More males were found in the >7 days treatment group (60%), compared to the <7 days treatment group but loss of significance statistically (Table 1). The median age found in the <7 days treatment group was 58 years, while in the >7 days treatment group was 63 years, however no statistically significant results were found (p>0.05). The median value

Table 1. Clinical Characteristic Ischemic Stroke Patients

Characteristics	≤7 days (n=32)	>7 days (n=27)	P
Gender			0.315
Male	16 (50%)	16 (60%)	
Female	16 (50%)	11 (40%)	
Age (IQR, median)	58 (38-80)	63(20-64)	0.352
Onset (hours) (IQR)	11(1-120)	7(1-48)	0.213
NIHSS (IQR)	6(3-12)	8(3-16)	0.121
NLR (IQR)	3.22(1.02-7.85)	4.41(0.98-46.78)	0.134
Complication (during hospitalization)	9 (28%)	16 (60%)	0.034

Note: National Institute of Health of Stroke Scale (NIHSS), Neutrophyl-to-Lymphocyte Ratio (NLR)

of stroke onset was found in the < 7 days treatment group, namely 11 hours, while in the > 7 days treatment group, namely 7 hours, but no statistically significant results were found (p> 0.05). The median NIHSS value was 6 in the <7 days treatment group, while in the group >7 days treatment, it was 8, but no statistically significant results were found (p> 0.05). The median NLR value in the <7 days treatment group, was 3.22, whereas in the >7 days treatment group, it was 4.41, but there were no statistically significant results (p>0.05). In terms of the incidence of complications, there was 28% in the < 7 days treatment group, whereas in the > 7 days treatment group, it was 60%, but no statistically significant results were found (p> 0.05).

Discussion

The most common complications during hospitalization in stroke patients are infection (pneumonia) and electrolyte disturbances (hyponatremia). Stroke-associated pneumonia is a complication that easily occurs in patients and has a significant effect on increasing the duration of hospitalization.[6] Hyponatremia in stroke often occurs either due to lack of intake or due to the influence of the stroke itself. The incidence of hyponatremia in stroke varies between 7 to 59.2%, and has a significant effect on increasing the duration of hospitalization.[7] The results of this study indicate that complications are an indicator that has a statistically significant effect between groups of ischemic stroke patients treated ≤7 days and >7 days at Dr. Hasan Sadikin General Hospital Bandung (28% vs 60%; p<0.05) during hospitalization.

Overall, complications that occur in stroke patients are found to have a much longer duration of hospitalization than patients without complications.[8] The results of this study is in line that complications that occur in ischemic stroke patients can extend the duration of hospitalization. However, the outcome after a stroke also depends on various factors that occur following the event and can lead to a poor result, and prolonged hospitalization itself increases the risk of complications. These include issues related to acute treatments, such as resistance to recanalization, reocclusion of blood vessels, or hemorrhagic transformation. Other factors include swelling in the brain, increased pressure within the skull, or infections that develop after the stroke. If doctors could accurately predict these complications, it could influence how they make decisions and potentially change current guidelines for stroke care. In fact, taking preventive measures or treating these complications early could lead to much better outcomes by preventing serious and life-threatening problems.[18]

The age difference between the two groups , ≤ 7 days and > 7 days, was 5 years (58 vs 63). Age is a risk factor for stroke that cannot be changed. Epidemiologically, the increased risk of stroke doubles after the age of 55 years.[9,10] In this study, both groups were in the >55 year category, so the results of this study were in accordance with the epidemiological study. Stroke prognosis depends heavily on the patient's initial features, such as age, gender, and the seriousness of the stroke, apart from complications during hospital treatment. It has been suggested that doctors' predictions about stroke outcomes, which are usually based on their experience and results from clinical studies, can lead to an overestimation of the chances of a positive outcome. Because there is a lot of variation among stroke patients in their starting conditions and in the factors related to the stroke itself, it is important to find outcome predictors that take multiple factors into account. These predictors need to be well-defined, consistent, and reliable. They should also be easy to measure in everyday medical practice and available when predictions are needed.[17]

There was a difference in the median time of arrival to the hospital in the treatment group < 7 days (11 hours) and > 7 days (7 hours) although it was not statistically significant (p> 0.05). Previous research stated that acute ischemic stroke patients who were brought to the hospital with an onset of less than 6 hours after the stroke event showed an outward picture of neurological improvement during hospitalization and better clinical outcomes after 3 months.[16] This causes patients with an earlier onset time to come to the

hospital to reduce the duration of hospitalization. This is inconsistent with the results of a study where a longer onset was found in the group < 7 days (11 hours vs 7 hours). This happened because Dr. Hasan Sadikin General Hospital Bandung is a top referral hospital in West Java province, where the majority of patients are referral patients from previous hospitals.

The description of the median NIHSS score between the treatment group < 7 days and > 7 days (6 vs 8) found that both were still in the moderate NIHSS category. NIHSS is one of the most frequently used tools today to describe the severity of a stroke. Previous studies have shown that baseline NIHSS scores can predict length of stay and expectancy of discharge.[15,16] This also serves to map the need for hospital beds, length of care, and costs during treatment. The results showed that there was no significant difference between the NIHSS treatment group < 7 days and >7 days. Neutrophil-lymphocyte Ratio (NLR) is one of the predictors that describes the inflammatory response process in ischemic stroke.[15,18] Previous studies have shown that high NLR is significantly associated with poor stroke patient prognosis.[16,18] A high NLR is associated with a 1.1 to 1.3-fold increased risk for a poor outcome. NLR can help as a potential prognostic biomarker to establish the prognosis and estimate the duration of hospitalization in stroke patients.[11,14,15] The results showed that there was a difference between the NLR treatment group < 7 days (3.22 vs 4.41), although it was not statistically significant (p> 0.05).

There are many complications that can occur in ischemic stroke patients, both before and during treatment. The most common complications are infections and electrolyte disturbances. Previous study has found that patients who were hospitalized with complications had a much longer duration of stay than patients without complications.[8] The results of this study show that the complications that occur in stroke patients ischemia can prolong the duration of hospitalization. There was a significant difference between the incidence of complications in the <7 days treatment group (28% vs 60%). The indicators used in this study are simple indicators that can be assessed easily in hospitals. The description in this study is expected to be the basis for determining strategies for the identification, prevention, and management of complications quickly, precisely and comprehensively in order to increase the rate of <7 days of treatment in ischemic stroke in hospital. Age, onset, degree of stroke, infection and many comorbid conditions in ischemic stroke patients can influence the risk of complications, so more comprehensive management is needed so that possible complications can be prevented and can be treated as early as possible so as not to result in prolonged treatment in ischemic stroke patients.[5,8]

Limitation of study

The retrospective nature of the data introduces information bias, which is not adequately assessed. These notes might not always be fully detailed or correct. Also, the study does not consider the treatments given to patients. Because of this, the group of patients included in the research may not be similar in all aspects, and small sample size could be as limitations of underpowered analyses.

Conclusion

In this study, complications such as infection and hyponatremia condition, during hospital treatment are resulted in a long period of stay in ischemic stroke patients. This can be the basis for developing strategies of standard procedures for the care of acute ischemic stroke patients to prevent in-hospital complication increase the indicators of stroke services by reducing the ischemic stroke duration of hospitalization.

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