Analysis of Mortality Risk in Stroke Patients for Optimizing Stroke Services

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Abstract

Introduction: The high mortality rate due to stroke causes a burden on health services, so it is essential to optimize stroke services. Mortality is one of the parameters used to assess stroke services. Hasan Sadikin General Hospital, as a stroke service support hospital, should carry out comprehensive service development, one of which is through continuous evaluation regarding the mortality rate of stroke patients being treated. This study aims to analyze the description of mortality in stroke patients at Hasan Sadikin General Bandung, Indonesia.

Subject and Methods: The study used a retrospective analytic method for stroke patients in the Neurology ward from January to April 2023. The patients were divided into two groups: those who died and those who returned home with improvement. Data were taken from medical records regarding age, onset, length of stay, NIHSS, initial leukocytes, NLR, and complications. The data were then analyzed using the Mann-Whitney correlation test.

Results: From this study showed that 22 patients died, and 70 patients were discharged with improvement. There were no statistically significant differences ($p>0.05$) in the variables of age, onset, and length of stay in the two groups. There were statistically significant differences ($p<0.05$) between the two groups on the NIHSS on admission, leukocyte count, NLR variables, and the presence or absence of complications.

Conclusion: NIHSS scores, leukocyte count, NLR, and complications significantly affect mortality in stroke patients. This can be the basis for preventing and managing complications to reduce mortality in stroke patients and achieve better-quality indicators of stroke services.

Keywords: Mortality, outcome, stroke

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I. Introduction

Stroke is one of the highest causes of disability and death worldwide.[1] Data from the American Heart Association/ American Stroke Association (AHA/ ASA) in Heart Disease and Stroke Statistics-2017 Updates states that in America, on average, every 40 seconds, someone experiences a stroke. Stroke, and every 4 minutes, someone dies from a stroke.[1] Stroke is the second leading cause of death in developing countries, where 10 to 12% of all deaths are caused by stroke, with a crude mortality rate of 50 to 100/ 100.000 patients.[2] In Indonesia alone, Riskesdas data 2018 showed an increase in the incidence of stroke events to 10.9/1.000 people.[3] This number increased from 2013 data, which showed only 7/1.000 people. Compared to other countries in Southeast Asia, Indonesia has the highest mortality rate based on age and sex (193.3/100.000). In the data submitted in the 2023 Indonesian Health Survey (SKI), it was found that there was a decrease in cases in the same age range, namely 15–54 years old. The decline in cases occurred from 19.9% to 11.5% or the total number of cases became 501,397 cases. From these data we can see that

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there is a decrease in the incidence of stroke, although the decrease is not yet significant.[4] Ischemic stroke patients going home alive is one of the clinical indicators of vertical hospitals in Indonesia because fast, precise, and responsive services largely determine the outcome of stroke patients being treated at Hasan Sadikin General Hospital as a stroke service support hospital should develop comprehensive services, one of which is through continuous evaluation regarding the mortality rate of stroke patients being treated.[3] Still, this mortality rate is influenced by various factors that cannot be separated from stroke patient services. This study aims to analyze the description of mortality in stroke patients at Hasan Sadikin General Hospital Bandung, Indonesia.

II. Methods

This study used an analytic and retrospective cohort design of stroke patients treated at the Neurology Ward of RSUP Dr. Hasan Sadikin, Bandung and had been the same treatment and procedur regarding the condition. Data was taken from medical records from January to April 2023 and divided into two groups: the patients who died and those who returned home. Data were taken from medical records in age, onset, length of stay, NIHSS at hospital admission, initial leukocytes, NLR, and complications. The inclusion criteria

were stroke patients as evidenced by a head CT scan and treated in the Neurology Ward of Hasan Sadikin General Hospital, Bandung. The exclusion criteria were patients who refused treatment, were forced to go home during treatment, and did not meet the diagnostic criteria for stroke in the middle of treatment. The data were then analyzed using the Mann-Whitney correlation test. The test's significance was determined based on the p-value <0.05. The study was conducted after obtaining ethical approval from the research ethics committee of RSUP Dr. Hasan Sadikin Bandung (LB.02.01/X.6.5/403/2023). This study complied with all relevant ethical regulations (including The Declaration of Helsinki).

III. Results

There were 92 patients, 22 died, and 70 were discharged with improvement, as shown in Table 1. The highest prevalence of inpatients with stroke was aged 55 – 74 years (53.5%), the onset of stroke was <48 hours (78.2%) with length of stay <7 days (51.1%). The Mann-Whitney analysis test showed no statistically significant differences (p>0.05) in the two groups' age, onset, and length of stay variables. Table 2 shows that the incidence of mortality in stroke patients tends to be higher with moderate stroke severity (72.7%) and an average NIHSS of 14.8, increased

Table 1. Clinical Characteristics of Stroke Patients

Characteristics	Dead (22) n(%)	Discharged(70) n(%)	n=92 (100%)	p*
Age (year)				
15-34	1 (4.5)	2 (2.9)	3 (3.3)	
35-54	5 (22.7)	25 (35.7)	30 (32.6)	
55-74	12 (54.5)	37 (52.9)	49 (53.3)	
>75	4 (18.2)	6 (8.6)	10 (10.9)	
Onset				
<48 hours	17 (77.2)	55(78.5)	72(78.2)	0.993
≥48 hours	5 (22.8)	15(21.5)	20(21.8)	
Length of stay				
<7 days	15(68.2)	32(45.7)	47(51.1)	
7-14 days	1(4.5)	31(44.3)	32(34.7)	
>14 days	6(27.3)	7(10)	13(14.2)	

*Mann-Whitney correlation test

Table 2. Correlation NIHSS, NLR, Leucocyte Count, and Complication with Mortality

Characteristics	Dead (22) n(%)	Discharged(70) n(%)	N=92 (100%)	p*
NIHSS				
Mild (<5)	0(0)	24(34.2)	24(26.1)	
Moderate (5-15)	16(72.7)	44(62.9)	60(65.2)	
Severe (16-20)	4(18.2)	2(2.9)	6(6.5)	
Very severe (>20)	2(9.1)	0(0)	2(2.2)	
NLR				
Normal (1-3)	1(4.5)	20(28.5)	21(22.8)	<0.001
Increase (>3)	21(95.5)	50(71.5)	71(77.2)	
Leucocyte count				
Normal (3.5 - 10.5 x103/μL)	5(22.7)	47(67.1)	52(56.5)	
Increase (>10.5 x103/μL)	17(77.3)	23(32.9)	40(43.5)	
Complication				
Yes	19(86.3)	33(47.1)	52(56.5)	
No	3(13.7)	37(52.9)	40(43.5)	

*Mann-Whitney correlation test

NLR (95.5%), leukocytosis (77.3%), and the presence of complications (86.3%). This tends to be inversely related to patients who survive after stroke with normal leukocytes (67.1%) and no complications (52.9%). The Mann-Whitney statistical analysis test was performed, and p=0.000, so there was a statistically significant difference (p<0.05) between the two groups on the NIHSS, Leukocytes, NLR, and the presence or absence of complications.

III. Discussion

Studies show that the increased mortality of stroke patients in hospitals is associated with increasing age.[4] In this study, the highest age prevalence of stroke patients with mortality was 55–74 years. This is consistent with the study.[5] Old age can be a risk of mortality due to old age stroke patients tend to have cognitive disorders that affect the decline in body function, thus making the degree of stroke severity higher. This study contradicts the study that where the highest age prevalence of mortality due to stroke occurs at age >75 years. This can be caused by several things, such as the type of stroke suffered, risk factors and complications, and the severity of comorbidities in patients.[6] The characteristic <48 hours of onset of in-

hospital mortality in stroke patients is associated with a time-dependent determination of stroke prognosis regarding the effectiveness of reperfusion therapy. The sooner treatment is given at the start, the lower the mortality rate in stroke patients.[7] Delays in providing adequate health services can have implications for delays or a decrease in the efficacy of thrombolytic therapy. This study found that most patients were brought to the hospital within <48 hours, but there was no significant relationship between onset and mortality in this study, indicating that onset is not the only predictor factor for mortality in stroke patients. This is in line with the study which stated that onset of <48 hours increased the efficacy of therapy compared to mortality; there were several other factors, including gender, age, stroke severity, length of stay, low socioeconomic level and education which could be associated with poor prognosis.[8]

Most of the length of stay and mortality in stroke patients in this study were ≤7 days of hospitalization (68.2%). Stroke mortality was also affected by the length of hospital stay, and predictors for hospitalization of 7 days or less differed from predictors of longer stay. Stroke

mortality showed that increasing mortality in the first peak during the first seven days after stroke onset during hospitalization.[9]

The National Institute of Health Stroke Scale (NIHSS) is a stroke severity assessment component that is usually used clinically to estimate the prognosis of patients with ischemic stroke.[10] In one study, the sensitivity and specificity of the NIHSS score in mapping in-hospital mortality in stroke patients were ischemic, respectively, 80.9% and 57.5%. In this study, the mean NIHSS score for patients with mortality was 14.8, while the mean NIHSS score for patients who survived treatment was 7.05. This is in line with the study of Tarvonen et al., where patients who have scores ≥5 NIHSS have more chances to be discharged; patients who have an NIHSS score of 6–13 are more likely to have a residual disability and require rehabilitation, while patients who have an NIHSS score ≥13 have a high mortality-related prognosis.[11] NIHSS of more than 15 was significantly associated with a high mortality rate.[12]

Increased Neutrophil-Lymphocyte Ratio (NLR) is the combined increase in neutrophils and decreased lymphocytes during inflammation and in the event of a stroke, indicating the severity of nerve damage.[14] In this study, an increase in NLR was found in 95.5% of stroke patients with mortality and 71.5 stroke patients who were discharged. This study is in line with the study where an increase in NLR at 24 hours of stroke events in patients indicates a higher risk of in-hospital death in stroke patients.[13] Height and longer duration of hospital stay, 77.3% of patients with mortality had an increased leukocyte count compared to survived patients.[15] An increase in leukocytes is associated pathophysiologically with infection and stroke prognosis. Injury to the brain that is ischemic will trigger the immune system, cause immune system alterations, and affect post-stroke outcomes. The presence of infection increases the incidence of mortality in stroke patients.[16] Increasing number of leukocytes is associated with short-term and long-term clinical outcomes of acute ischemic stroke.[17] As many as 86.3% of stroke patients reported in this study died of complications, and mostly because of pneumonia infection. This is inversely proportional to discharged patients, where 47.2% had complications. The presence of complications is a predictor factor for increasing the mortality rate of stroke patients in hospitals.[18] Related complications include brain edema, infection, cardiovascular disease, and metabolic disease. In this study, brain edema and respiratory infection were identified as the main complications, with an accuracy rate approaching 90% as predictors of in-hospital mortality.[19]

IV. Conclusion

NIHSS scores, leukocyte count, NLR, and complications significantly affect mortality in stroke patients. This can be the basis for preventing and managing complications to reduce mortality in stroke patients and achieve better quality indicators of stroke services. Need future research using another score such as Modified Rankin Scale (MRS) score that can be more implemented in sub-acute or chronic stroke to predict stroke outcome.

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