

**Original Research**

## **Stroke Severity and Level of Dependence Against Risk of Falls in Stroke Patients**

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**ABSTRACT**

A stroke is a neurological disease caused by the blockage or rupture of blood vessels in the brain. Functional dysfunction due to stroke causes stroke patients to be very susceptible to falls. This research aimed to identify the association between the severity of stroke with the level of patient dependence on the risk of falls. This research was a quantitative observational design with a cross-sectional approach. The sample of this study was 66 hospitalized stroke patients who were recruited by quota sampling method. The National Institute of Health Stroke Scale (NIHSS) and Barthel Index are used to measure stroke severity and level of dependence. We assessed the risk of falls using the operational procedure from the hospital. Based on the Spearman rho test, it is found that there is a significant relationship between stroke severity and the level of risk of falls ( $p=0.000394$ ). Similarly, a significant correlation was found between the level of patient dependence and the level of risk of falls ( $0.000016$ ). Nurses need to set the nursing care plan for stroke patients who are at risk of falls to prevent further injuries and complications. Continuity of care and family support will help the patient's dependency, reduce the risk of falls, and promote quality of life.

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## Introduction

Stroke is a neurovascular disorder resulting in decreased cerebral perfusion. Damage to cerebral blood vessels causes the blood supply to the brain to stop, resulting in incidents that lead to neurological deficits (Kuriakose & Xiao, 2020). Based on the cause, stroke is divided into two types, namely hemorrhagic stroke (bleeding stroke) and non-hemorrhagic stroke (ischemic) caused by plaque blockage (Linga, 2013). About 85% of fatalities in stroke patients occur in ischemic occlusion (Musuka et al, 2015). Ischemic occlusion causes thrombosis and embolism. Atherosclerosis leads to thrombosis formation and narrowing of blood vessels in the brain and generates diminished blood flow. Decreased blood flow in the brain causes brain cell damage and cell death (necrosis), contributing to neural function loss (Kuriakose & Xiao, 2020). Another type of stroke is hemorrhagic stroke, with a high mortality rate contributing to around 10-15% of strokes. Blood accumulation harms brain cells and causes infarction (Musuka et al., 2018).

One of the most common manifestations of neural function loss is the weakness of muscles and loss of muscle control (Kuriakose & Xiao, 2020). This condition generates a common and dangerous consequence, which is falls. Fall for an individual patient may be not only causing physical injury but also an increase in dependency, fear, impaired physical activity, and depression (Persson & Hansson, 2021).

In their implementation of care, hospitals should prioritize the patient safety aspect because patients come to the hospital to obtain safety from the illness they experience. As one of the indicators of patient safety goals, the risk of falling is a major issue of utmost concern (Hadi, 2017). Falls and stroke are closely related as stroke is a neurological disease that often causes weakness or paralysis of the body's extremities. Falls, according to WHO, is defined as an event that causes a person to stop accidentally on the ground or on a lower floor (WHO, 2018).

The incidence of falls is still quite high in the world; this can be seen from WHO data (2018) which shows that every year an

estimated 646,000 people die from falls globally, of which more than 80% are in low- and middle-income countries. Adults over the age of 65 suffered the greatest number of fatal deaths. 37.3 million falls severe enough to require medical attention occur each year (WHO, 2018). In Indonesia, the incidence of falls has not been recorded nationally, but it can be found in the internal database of each hospital. The researchers themselves obtained data on falling patients at the National Brain Center Hospital Jakarta during 2020, as many as 47 cases. With details of the most cases occurred in both adults patients ward 7B floor was 13 cases and in the 7A floor was 12 cases of patients falling.

The incidence of falls in stroke patients is reported to range from 7% one week after the stroke to 73% in the first year after discharge from the hospital. Some other consequences caused by falls include hematomas, lacerations, and soft tissue damage. Meanwhile, other more severe conditions include open and closed fractures, intracranial hematomas, and massive bleeding. Even if a fall does not occur, the limitation of movement can affect the patient's emotional stability because the patient is afraid of falling (Djurovic et al., 2021). These falls can cause various negative impacts, such as lengthening the rehabilitation period, lengthening the length of stay, and increasing the cost of care (Walsh et al., 2016).

Research conducted in the Slovak Republic by Miertová et al. (2018) found that the elderly generally have a greater risk of falling and in combination with neurological disease, gait, and balance disorders, perceptual disturbances (vision, hearing, continence, sleep, cognitive deficits, depression and a positive history of falls) increase the risk of falling. According to Yuneiwati (2015), stroke patients are at risk of falling because of the neurological deficit impacts. Neurological deficits in stroke patients can be assessed based on the National Institutes of Health Stroke Scale (NIHSS).

In addition to the severity of a stroke, which describes neurological deficits, another thing that causes stroke sufferers to be at risk of falling is the level of dependence of stroke patients themselves. Dependency in stroke patients mostly affects daily activities. This is

a common impact of post-stroke, and it can be persisted in 35% of stroke patients within the first year of stroke (Wurzinger, 2021). The level of dependence of stroke patients can be assessed using the Barthel index scale.

Clinical attention has been applied in the hospital setting to prevent falls, especially in stroke patients. However, the incidence of falls is still high and continuous studies related to fall prevention, identifying factors related to falls, and management in stroke patient is still needed. This research aimed to identify stroke severity level and independence level against fall risk in stroke patients.

## Method

This is observational quantitative design research. The data were collected from the medical records of patients treated in 7A ward, National Brain Center Hospital, Jakarta. The data taken are fall risk score, NIHSS score, and Barthel Index score, that were obtained during the initial assessment of patients in the 7A ward. Based on sample size calculation using Slovin formula with a population was 193 stroke patients, this study used 66 samples with a quota sampling method. The inclusion criteria of this study were adult patients with hemorrhagic and non-hemorrhagic (ischemic) stroke, and the exclusion criteria were patients with the diagnosis of Transient Ischemic Attack (TIA).

The instrument used in this study were the National Institute of Health Stroke Scale (NIHSS) to measure stroke severity, Bartel index to measure the level of dependency, and the Fall Risk Screening as standard operational procedure from the hospital. In order to test the relationship between two ordinal variables, Spearman's

rho test was used in this study with a significant p-value  $< 0,05$ . The ethical clearance of number LB.02.01/KEP/097/2021 was approved by the ethics committee of the National Brain Center Hospital. Permission to collect data from medical records was granted by the Medical Record section of the National Brain Center Hospital.

## Results and Discussion

### Results

The results of the data analysis in Table 1 showed that the majority of patients are male. While in terms of age, most patients with stroke were older adults (above 50 years old). It is also can be seen that more than half of stroke patients experienced mild neurological deficits (56.1%). The rest of the patients experienced moderate neurological deficits (33.3%) and severe neurological deficits (10.6%). Based on the patient's level of idependency, most patients were slightly dependent (39.4%), followed by moderate dependence (12.1%), severe dependence (21.2%), and total dependence (21.2%). Only four patients were independent (6.1%).

From the analysis of the Spearman's rho test in Table 2, it was found that the value of Sig = 0.00033, which indicates there is a significant relationship between the severity of a stroke and the level of risk of falling. As for the level of strength of the relationship itself, the correlation coefficient value = 0.488, indicating the result is moderate and has a positive sign, which means that there is a tendency for the severity of stroke increases, and the risk of falling will also increase.

**Table 1. Frequency Distribution In Stroke Patient**

Data	Description	Amount	(%)
Gender	Male	37	56.1
	Female	29	43.9
Age (year)	26-35	2	3.0
	36-45	4	6.1
	46 - 55	19	28.8
	56 - 65	24	36.4
	>65	17	25.8
Stroke Severity Level (NIHSS)	•Mild Neurological Deficit	37	56.1
	•Moderate Neurological Deficit	22	33.3
	•Severe Neurological Deficit	7	10.6
	•Very Severe Neurological Deficit	0	0
Patient Dependency Level (Barthel Index)	•Independent	4	6.1
	•Slight independency	26	39.4
	•Moderate Independency	8	12.1
	•Severe dependency	14	21.2
	•Total dependency	14	21.2
Fall Risk Level	•Low Risk	7	10.6
	•Medium Risk	50	75.8
	•High Risk	9	13.6

**Table 2. The Relationship between Stroke Severity Level and Fall Risk Level**

Correlations			Severity of Stroke	Risk Fall
Spearman's rho	Severity of stroke	Correlation Coefficient	1.000	.488**
		Sig. (2-tailed)	.	.000033
		N	66	66
Risk Fall	Risk Fall	Correlation Coefficient	.488**	1.000
		Sig. (2-tailed)	.000	.
		N	66	66

\*\* . Correlation is significant at the 0.01 level (2-tailed).

**Table 3. The Relationship between Patient Independence Level and Fall Risk Level**

Correlations			Level of dependency	Risk of Falls
Spearman's rho	Level of dependency	Correlation Coefficient	1.000	.538**
		Sig. (2-tailed)	.	.000003
		N	66	66
Risk of Falls	Risk of Falls	Correlation Coefficient	.538**	1.000
		Sig. (2-tailed)	.000	.
		N	66	66

\*\* . Correlation is significant at the 0.01 level (2-tailed).

From the analysis of the Spearman's rho test in Table 3, it was found that the value of Sig = 0.000003, which indicates there is a significant relationship between the patient's level of independence and the level of risk of fall. While the level of strength of the relationship itself, the correlation coefficient value = 0.538 indicates a strong result and is positive, which means that there is a tendency to decrease the patient's level of independence

(increasing patient dependence), the higher the risk of falling.

### Discussion

Age is a dependent factor on the occurrence of a stroke, whereby the number of stroke incidences doubles after the age of 55 years (Kuriakose & Xiao, 2020). From the study, it can be seen that stroke occurs more in men than women. Both genders can be affected by stroke; however, men have a

higher incidence rate than men (Hiraga, 2017). However, when women experience strokes, they have lower functional outcomes and lower quality of life than men. It is because stroke incidence in women may cause a decrease in sex hormones and coagulation status (Hiraga, 2017). The presence of stroke related to gender also depends on age. In women, stroke occurs at a younger age, while in men, stroke occurs at an older age. Stroke in younger women is related to preeclampsia, contraception, and hormonal therapy. While in women above 75 years, 20% of stroke is due to atrial fibrillation (Kuriakose & Xiao, 2020). In terms of gender-specific stroke, the mean stroke severity was 10 for women and 8.2 for men (Kuriakose & Xiao, 2020).

The severity of stroke based on the NIHSS category showed that half of the patients had mild neurological deficits (56.1%). In contrast, the rest had moderate neurological deficits (33.3%) and severe neurological deficits (10.6%). The findings corroborate with a study conducted by Reeves et al. (2013) in the Cincinnati/Northern Kentucky USA, who examined the distribution of NIHSS in ischemic stroke cases with retrospective data, and the result showed that the overall mean NIHSS score was mild neurological deficits. Other research conducted by Mahdy et al. (2019) in Egypt aimed to evaluate whether the NIHSS score at admission in acute primary ICH patients could be a predictor of short-term outcomes. It was known that patients with mild neurological deficit occurred in 51 patients (43.3%), severe occurred in 36 patients (30%), and moderately severe occurred in 28 patients (23.3%). Meanwhile, the results of other research in Indonesia conducted by Sekeon & Kembuan (2015) at Rumah Sakit Umum Pusat (RSUP) Prof. Dr. RD Kandou Manado, which examined the relationship between sleep quality and stroke severity, showed that based on the degree of a neurological deficit from a total sample of 120 patients, the frequency distribution of mild neurologic deficit was 25.5%, moderate 58.8%, and severe 15.7%.

Determinants of falls in stroke are multifactorial. A study was conducted by Persson and Hansson (2021) on 5605 stroke patients at a Swedish university hospital. The findings showed that determinants of falls in

stroke related to men's gender, hemorrhagic stroke, moderate symptoms (based on NIHSS score), smoking, impaired postural control in walking and standing, arm and hand problems, impaired cognition, and urinary tract infection. The most significant determinant of falls is impaired postural control when walking. Impaired cognition contributes to a decrease in awareness of neurological deficits or postural control impairment, which could increase in the risk of falls (Persson & Hansson, 2021).

Stroke patients with mild functional disturbances tend to experience a high risk of falls. Even though they have some limitations in mobility, they are still able to perform some reasonable activities. Thus they are more at risk of falls. Meanwhile, stroke patients with severe stroke levels who experience low functional status tend to be physically immobile, and thus they are less exposed to any circumstances in which they are at risk of falls (Wei, 2019).

Disorders of brain function that occur in stroke will result in functional brain disorders in the form of thought process disorders, speech disorders, memory disorders, and movement disorders (Lewis et al., 2014). Movement disorders in stroke patients cause dependency in most of the patient's daily activities that require assistance, including basic fulfillment activities such as bathing, eating, and urinating.

Based on the findings in this study, the highest level of dependence of patients with mild dependence was 39.4%, and moderate dependence was 12.1%. At the same time, respondents with severe and total dependence were 21.2% of each. Based on the study conducted by Wurzinger (2021), the level of dependency on activity daily living at 3 and 12 months is related to the patient's dependency within 36-48 hours after admission to the hospital. Dependency was identified by some factors, including cognitive impairment and older age. However, the severity of the stroke did not relate to the dependency in activity daily living (Wurzinger, 2021).

The finding of this study shows that most patients (75.8%) were at moderate risk of falls. In comparison, only a small number of



patients had low risk and high risk of falls, 10.6% and 13.6%, respectively. In this study, it can be seen that there was a significant relationship between stroke severity and the level of risk of falls in hospitalized stroke patients.

However, stroke severity was not related to the risk of falls post-stroke, as shown through the research results conducted by Samuelsson et al. (2019) in Sweden. The research aimed to identify the incidence of falls and factors present immediately after stroke, which was associated with the incidence of falls during the first 12 months after stroke onset. Five hundred forty post-stroke patients were assessed using NIHSS. The result showed that 38 of 165 respondents (23%) had experienced at least one fall within three months after discharge.

In the six and twelve months following the stroke, respondents had experienced at least one fall on 108 of 376 (29%) and 140 of 348 (40%), respectively. The mean NIHSS scores were generally low in those studies, which may explain the results, but even individuals with very high NIHSS scores may have a reduced risk of falling due to immobility. The difference in results between the previous study with the existing study could be due to the fact that the previous study examined the prediction of risk factors for falling during the first 12 months of having a stroke. Meanwhile, in this existing study, the NIHSS score was collected when the patients were still hospitalized.

In this study, it can also be seen that there is a significant relationship between the patient's level of dependence and the level of risk of falling. Research that supports this finding was conducted by Dokuzlar et al. (2020) in Turkey, which showed that cerebrovascular disease had a significant correlation with an increased risk of falling through four different clinical methods ( $p < .001$ ).

The author can assume that the more dependent a patient is in carrying out daily activities, the higher the risk of falling. The reason for this association is not obvious, but it might be related to the severe fatigue that often occurs during the first days of stroke event of hospitalization.

Rehabilitation for falls after stroke is necessary in order to increase mobility impairment and improve independence. A rehabilitation program is also important in managing risk factors of falls through activities and intervention to improve strength, balance, and gait speed (Ainuddin et al., 2021).

For the prevention of falls in patients who are dependent on other people, it is necessary to have other people who are always there and ready to help, such as caregivers, because if there is no one, the patient will try to do it themselves which will expose them to the risk of falling. Since dependency on daily activities changes over time, nurses need to set nursing care plans and goals to measure patient needs in a particular aspect of mobility at any stage.

### **Conclusion**

This study showed that there was a significant correlation between the severity of stroke with the level of risk of falls and a significant correlation between the patient's level of dependence with the level of risk of falling. Therefore, assistance for a stroke patient who experiences movement disorders is always needed to prevent falls.

### **Limitations of the study**

The limitation of this research is the use of nonprobability sampling methods in which the study result cannot be generalized. This study assessed the risk of stroke severity and level of dependence with risk of falls in general stroke, while it could be a different characteristic in the different types of stroke related to stroke severity, level of dependency, and risk of falls.

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