Original Article

Differences in the Degree of Spasticity in Post-Haemorrhagic and Non-Haemorrhagic Stroke Patients Based on the Modified Ashworth Scale

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Abstract

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Background : Stroke is a brain function disorder caused by vascular disturbances with manifestations ranging from paralysis to death. Stroke is a health issue with high incidence and mortality rates. Furthermore, post-stroke patients can experience various residual symptoms such as spasticity, which can lead to decreased productivity and socio-economic impacts. Spasticity is a common symptom in stroke survivors, with a prevalence ranging from 30% to 80%. This symptom typically appears several weeks after a stroke and can persist for up to 12 months, causing reduced productivity and socio-economic challenges. Hemorrhagic strokes result from blood vessel rupture, while non-hemorrhagic strokes are caused by ischemia. Both types can damage motor pathways, leading to spasticity. Understanding the differences in spasticity severity between stroke types may guide targeted rehabilitation strategies. The aimsof ths study was to determine the difference in the degree of spasticity in post-stroke patients between hemorrhagic and non-hemorrhagic strokes based on the Modified Ashworth Scale.

Methods : An analytical observational study with a cross-sectional design was conducted. The study included 33 post-hemorrhagic stroke patients and 33 post-non-hemorrhagic stroke patients. The degree of spasticity was measured using the Modified Ashworth Scale. Statistical analysis was performed using the Chi-Square test.

Results : The Chi-Square test for the variable "stroke type" and "degree of spasticity" yielded a p-value of 0.428 ($p > 0.05$). The Chi-Square test is considered significant when the p-value is < 0.05.

Conclusion : There is no difference in the degree of spasticity in post-stroke patients between hemorrhagic and non-hemorrhagic stroke types.

Keywords : Haemorrhagic Stroke, Non-Haemorrhagic Modified Ashworth Scale, Stroke, Spasticity.

INTRODUCTION

Stroke is a collection of symptoms with manifestations ranging from paralysis to death due to a disruption in brain function that lasts for more than 24 hours.[1] The collection of symptoms arises from vascular causes and is not caused by other factors.[2] There are two main classifications of stroke, namely hemorrhagic and non-hemorrhagic. Hemorrhagic stroke accounts for 15% of stroke cases, while non-hemorrhagic stroke accounts for 85%.[3] Globally, stroke is the second leading cause of death.[4] In Asia itself, Indonesia has the highest incidence of stroke and ranks third in terms of mortality in Indonesia, following cancer and heart disease.[5]

In addition to high incidence and mortality rates, stroke survivors who successfully pass the critical period may experience functional impairments leading to a decline in productivity.[6] Patients who have experienced a stroke may undergo nerve changes due to damage to upper motor neurons, resulting in muscle stiffness (spasticity), characterized by a decrease in range of motion and an increase in muscle tone. As a result, stroke survivors may become dependent on others for their daily activities.[7–9] Post-stroke spasticity can occur between 19% and 92%, especially in the first year after a stroke. Estimates of prevalence vary widely due to differences in spasticity measurement instruments and the onset of stroke.[9]

Previous studies indicate that spasticity is a common symptom after a stroke, with a prevalence ranging from 30% to 80% among stroke survivors.[10] It is a persistent symptom in post stroke patients and can lead to disabilities. Spasticity begins to emerge around the second week and reaches its maximum level in the third week after an ischemic stroke.[11] In another study, it is mentioned that spasticity can persist for up to 12 months, even with the administration of physiotherapy.[11,12] However, to date, there is no research on the differences in the degree of spasticity in post-stroke patients between hemorrhagic and non-hemorrhagic types.

The fundamental difference between hemorrhagic and non-hemorrhagic strokes lies in the fact that hemorrhagic stroke involves the rupture of blood vessels in the brain, leading to the accumulation of blood in the intracranial space. This accumulated blood can rapidly and extensively damage the brain, as it quickly disrupts neurons. Meanwhile, non-hemorrhagic stroke occurs when blood flow to certain parts of the brain is insufficient, resulting in ischemia. This type of stroke is not as dangerous as hemorrhagic stroke because the extent of damage is smaller, and the onset is not as rapid as in hemorrhagic strokes.[13] Brain damage due to stroke can affect the pyramidal and extrapyramidal tracts, leading to the development of spasticity.[10] Based on this premise, researchers are interested in investigating the differences in the degree of spasticity in hemorrhagic and non-hemorrhagic stroke patients. Understanding the differences in spasticity severity between stroke types may guide targeted rehabilitation strategies.

The degree of spasticity in this study will be measured using the Modified Ashworth Scale. The Modified Ashworth Scale (MAS) is a scale commonly used to assess increased muscle tone manifested by increased joint resistance during passive movement. Increased muscle tone is often exhibited in pathological conditions such as stroke, multiple sclerosis, spinal cord injury, traumatic brain injury, cerebral palsy, and other neurological conditions that result in damage with upper motor neuron (UMN) lesions.[14] The Modified Ashworth Scale is determined manually by passively moving the patient's extremities and sensing the resistance and reduction in range of motion (ROM).

METHODS

The research was conducted in June–July 2023 using an analytical observational approach with a cross-sectional design. 66 samples were included 33 post-hemorrhagic and 33 post-non-hemorrhagic stroke patients at Dr. M. Ashari Regional General Hospital, Pemalang, selected through purposive sampling. Inclusion criteria included patients aged 45 years and above, those who had experienced a stroke at least 3 months prior, and those who had not undergone physical therapy for at least 1 week before participation. Exclusion criteria involved patients with neurological or musculoskeletal disorders affecting range of motion.

Subjects underwent spasticity assessment using the Modified Ashworth Scale (MAS) for both upper and lower extremities, with the highest spasticity value recorded. The classification of stroke type (hemorrhagic or non-hemorrhagic) was confirmed using medical records.

The data collected included primary data (spasticity degree obtained through direct examination by the researcher) and secondary data (stroke type and gender from medical records). Since the researcher collected all data independently, no inter-rater reliability test was conducted.

Confounding Factors: Duration since the stroke (minimum 3 months) was evaluated as a potential confounding factor; Gender data was also collected to analyze potential differences between male and female subjects.

Data analysis involved hypothesis testing to evaluate differences in spasticity degree between stroke types. Spasticity was categorized into two groups: mild spasticity (MAS 0, 1, and 1+) and moderate-to-severe spasticity (MAS 2, 3, and 4). A Chi-Square test was used, with a p-value of <0.05 considered statistically significant.

RESULTS

Characteristics of research subjects

Further details on the characteristics of the research subjects can be found in the Table 1.

From the data collected, which met the inclusion and exclusion criteria, the study included 66 patients. The sample was evenly divided between those with hemorrhagic and non-hemorrhagic stroke. Just over half of the participants were female. Most of the patients were aged 60 and above, and a majority had been experiencing post-stroke symptoms for six months or more, while a smaller group was within six months after their stroke. The degree of spasticity ranged from normal to severe, with most patients exhibiting mild to moderate levels of

TABLE 1
Characteristics of research subjects

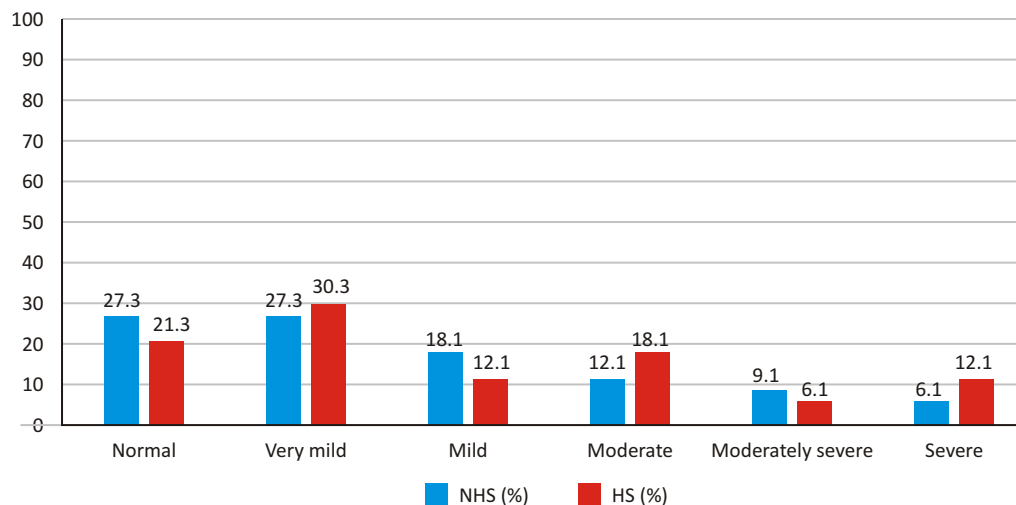| Characteristic	Category	n	%
Type of Stroke	NHS	33	50%
	HS	33	50%
Gender	Male	31	47%
	Female	35	53%
Age	<60 Years	29	43.9%
	≥60 Years	37	56.1%
Onset of Stroke	<6 Months	11	16.7%
	≥6 Months	55	83.3%
Degree of Spasticity	0 (Normal)	16	24.2%
	1 (Very mild)	19	28.8%
	1+ (Mild)	10	15.2%
	2 (Moderate)	10	15.2%
	3 (Moderately severe)	5	7.6%
	4 (Severe)	6	9.1%

Figure 1. Distribution of the degree of spasticity based on the type of stroke.

spasticity.

The degree of spasticity in patients was assessed using the Modified Ashworth Scale (MAS). The results showed that most patients had normal to very mild spasticity, while fewer exhibited moderate to severe spasticity. Further analysis was conducted to examine the distribution of spasticity levels for each type of stroke.

The degree of spasticity for each type of stroke is as follows: for non-hemorrhagic stroke, there are 9 patients with normal spasticity, 9 patients with very mild spasticity, 6 patients with mild spasticity, 4 patients with moderate spasticity, 3 patients with moderately severe spasticity, and 2 patients with severe spasticity. For hemorrhagic stroke, there are 7 patients with normal spasticity, 10 patients with very mild spasticity, 4 patients with mild spasticity, 6 patients with moderate spasticity, 2 patients with moderately severe spasticity, and 4 patients with severe spasticity (Figure 1).

Hypothesis Testing

The degree of spasticity will be divided into two main groups: the mild spasticity group (MAS normal, very mild, and mild) and the moderate-severe spasticity group (MAS moderate, moderately severe, and severe).

Based on Table 2, the *p*-value for the variable type of stroke with the degree of spasticity is $p=0.428$ (p >0.05). The Chi-Square analysis shows that there is no significant difference in the distribution of spasticity degrees (mild vs. moderate-severe) between hemorrhagic stroke (HS) and non-hemorrhagic stroke (NHS) patients ($\chi^2 = 0.626$, df = 1, $p=0.428$). Therefore, it can be concluded that there is no significant difference in the degree of spasticity between patients with hemorrhagic stroke and non-hemorrhagic stroke.

Based on Table 3, the *p*-value for the variable age group with the degree of spasticity is $p = 0.140$ ($p > 0.05$). The Chi-Square analysis shows that there is no significant difference in the distribution of spasticity degrees (mild vs. moderate-severe) between patients aged < 60 years and those aged > 60 years ($\chi^2 = 2.175$, df = 1, $p = 0.140$). Therefore, it can be concluded that there is no significant difference in the degree of spasticity between the two age groups.

TABLE 2
Chi-Square test between the type of stroke and the degree of spasticity

Type of Stroke	Degree of Spasticity		Total	*p*
	Mild	Moderate–Severe		
NHS (%)	24 (72.7)	9 (27.3)	33 (100)	
HS (%)	21 (63.6)	12 (36.4)	33 (100)	0.428
Total (%)	45 (68.2)	21 (31.8)	66 (100)	

TABLE 3
Chi-Square test between age and the degree of spasticity

Age	Degree of Spasticity		Total	*p*
	Mild	Moderate–Severe		
<60 years (%)	17 (58.7)	12 (41.3)	29 (100)	
≥60 years (%)	28 (75.7)	9 (24.3)	37 (100)	0.140
Total (%)	45 (68.1)	21 (31.9)	66 (100)	

TABLE 4
Chi-Square test between the onset of stroke and the degree of spasticity

Onset of stroke	Degree of Spasticity		Total	*p*
	Mild	Moderate–Severe		
<6 months (%)	9 (81.9)	2 (18.1)	11 (100)	
≥6 months (%)	36 (65.5)	19 (34.5)	55 (100)	0.287
Total (%)	45 (68.2)	21 (31.8)	66 (100)	

Based on Table 4, the *p*-value for the variable onset of stroke with the degree of spasticity is *p*=0.287 (*p* >0.05). The Chi-Square analysis shows that there is no significant difference in the distribution of spasticity degrees (mild vs. moderate-severe) between patients with a stroke onset of < 6 months and those with an onset of > 6 months (χ^2 = 1.135, df = 1, *p*=0.287). Therefore, it can be concluded that there is no significant difference in the degree of spasticity between the two onset groups.

DISCUSSION

The result of this study is no differences were found in the severity of spasticity between post-hemorrhagic and post-non-hemorrhagic stroke patients, all with a duration of more than 3 months.

Spasticity more frequently occurs in hemorrhagic strokes, as indicated by the research results, with the number of patients who are normal (without spasticity) being nine in post-non-hemorrhagic stroke patients, whereas in post-hemorrhagic stroke patients, it is seven. This is in line with the study by Hualing *et al.*, which stated that hemorrhagic strokes have a higher prevalence of spasticity.[12,15] This is because the damage in hemorrhagic strokes is more extensive due to direct bleeding affecting brain parenchymal tissue. However, the more frequent occurrence of spasticity does not necessarily mean a greater severity. Although the difference in the proportion of the presence or absence of spasticity appears slight, this can be explained by the study by Katoozian *et al.*, which states that post-stroke spasticity more frequently occurs in hemorrhagic stroke patients, with the onset of spasticity most common in the first month post-stroke.[16] Considering that this study includes post-stroke patients with a duration of more than 3 months, it is not impossible that many non-hemorrhagic stroke patients have already developed spasticity.

The findings in this study align with research by Hualing *et al.*, which observed that hemorrhagic strokes have a higher prevalence of spasticity due to more severe brain damage from direct bleeding into the parenchyma. In the current study, post-hemorrhagic stroke patients showed a slightly lower proportion of normal (spasticity-free) patients compared to post-non-hemorrhagic stroke patients (7 vs. 9). This finding supports Hualing *et al.*'s conclusion that hemorrhagic stroke is more likely to result in spasticity. However, Katoozian *et al.* note that spasticity tends to manifest within the first month post-stroke, particularly in hemorrhagic stroke patients, which may explain why, after 3 months, both groups in this study showed similar levels of spasticity. The longer duration post-stroke in this study (over 3 months) likely allowed for the development of spasticity in non-hemorrhagic stroke patients as well.

The degree of spasticity, for which differences were sought in this study, was divided into two groups: post-non-hemorrhagic stroke patients and post-hemorrhagic stroke patients. However, no significant difference was found in the severity of spasticity. This is because the severity of spasticity is determined by many factors, including lesion location, age, history of hypertension, history of diabetes, stroke severity, management in the acute phase, and individual responses to nerve damage.[17] In some cases, spasticity may be more severe in hemorrhagic strokes, while in other cases, the degree of spasticity may be more severe in non-hemorrhagic stroke patients. Therefore, to determine whether there is a difference in the degree of spasticity in post-stroke patients between hemorrhagic and non-hemorrhagic types, many other factors need to be considered, and the type of stroke alone is not sufficient to be the determinant of spasticity severity.[18]

Schinwelski *et al.* emphasize that spasticity severity is influenced by numerous factors beyond stroke type. These include lesion location, patient age, comorbidities (such as hypertension and diabetes), initial stroke severity, acute-phase management, and individual variability in nerve damage response. This complexity explains why no significant difference in spasticity severity was observed between hemorrhagic and non-hemorrhagic strokes in this study. The type of stroke alone does not adequately predict spasticity outcomes; rather, a multifactorial approach is required to fully understand the variability in spasticity severity. Future studies should take these additional factors into account to provide a more comprehensive understanding of spasticity in post-stroke patients.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that there is no difference in the degree of spasticity in post-stroke patients between hemorrhagic and non-hemorrhagic types at RSUD Dr. M. Ashari Pemalang.

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