RESEARCH ARTICLE

Difference between Nutrition Status in First and Recurrent Ischemic Stroke Patients: a Retrospective Cross-Sectional Study

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Abstract

Malnutrition in stroke patients can be caused by neurological deficits such as decreased consciousness, dysphagia, cranial nerve paresis, and hemiparesis/hemiplegia. The condition of malnutrition seriously impacts healing and can exacerbate the underlying disease, in this case, stroke, so malnutrition in stroke patients extends the length of stay and increases morbidity and mortality. This study compares nutritional status between first and recurrent ischemic stroke patients based on body mass index (BMI) and subjective global assessment (SGA). This study is a comparative analysis of the medical records of ischemic stroke patients in Dr. Hasan Sadikin General Hospital Bandung from January 2018 until December 2020. The chi-square and Fisher's exact tests were used for statistical analysis. The significance criteria are the p-value if p≤0.05 means statistically significant. A total of 236 subjects in both groups of first and recurrent ischemic stroke patients consisting of 130 men and 106 women with an average age of 56.64 and 61.75 years, and the majority had risk factors for hypertension. The first ischemic stroke group has a good nutrition status compared with the recurrent stroke group (p<0.05). Thirteen patients (11.02%) of first ischemic stroke and 11 patients of recurrent ischemic stroke (9.32%) were underweight, 67 patients (56.78%) of first ischemic stroke and 74 patients of recurrent ischemic stroke (62.71%) had average weight, 31 patients (26.27%) first ischemic stroke and 33 patients (27.97%) recurrent ischemic stroke were overweight, five patients (4.24%) first ischemic stroke and seven patients (5.93%) recurrent ischemic stroke were obese (p<0.05). In conclusion, there was a significant difference in the nutritional status of first and repeated ischemic stroke patients. The nutritional status of recurrent ischemic stroke patients is worse than that of first ischemic stroke patients.

Keywords: BMI, first ischemic stroke, nutritional status, recurrent ischemic stroke, SGA

Introduction

Stroke is a life-threatening disease and causes a significant burden of death in developing and developed countries. At present, stroke is one of the major global health problems, causing 75.2% of deaths and 81.0% of disability in developing countries. Up to 87% of the global burden of stroke is ischemic stroke.[1] The prevalence of stroke in Indonesia, according to the Basic Health Research (*Riskesdas*), in 2018 was 10.9 cases per mile, while in West Java province, it was 52,511 cases or around 11.4%.[2] One of the data on hospitals in Indonesia explained that more than 500 people per year are treated for stroke.[3]

Stroke has various clinical symptoms, depending on the location of the brain damage caused. One of these manifestations is a neurogenic deficit that can lead to low nutritional intake in stroke patients. In addition, the presence of chronic diseases such as diabetes mellitus and hypertension and difficulty swallowing are also associated with an increased risk of malnutrition in stroke patients.[4,5] If this occurs continuously, stroke patients may experience malnutrition, which will affect clinical outcomes, quality of life, bodily functions, and patient autonomy.[6]

In addition to the resulting clinical manifestations, stroke can also cause various complications, one of which is recurrent stroke.[5,7] Malnutrition in recurrent stroke is exacerbated by disruption of nutritional intake caused by clinical manifestations after the first attack.

In a previous study conducted on stroke patients, it was found that the majority of stroke patients were malnourished in the moderately malnourished category based on the subjective global assessment (SGA) rating.[8] The nutritional status of recurrent ischemic stroke patients is worse than that of first ischemic stroke patients. Compared with the first stroke, the resulting nerve damage is more serious, more difficult to treat, and has a higher mortality.[5,7] This causes the resulting nutritional status to be worse. If this is known, management in terms of nutrition, such as providing adequate and appropriate nutrition,

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can produce positive results for the health and well-being of the patient.[9]

Based on this description, it is necessary to conduct research on the comparison of the nutritional status of first and repeat ischemic stroke patients, with a relatively high prevalence of stroke (11.4%) and exceeding the national prevalence (10.9%).[2] In this study, nutritional status based on SGA and body mass index (BMI) will be the parameters studied so that it can meet the criteria for detection of malnutrition based on the Global Leadership Initiative on Malnutrition (GLIM), namely one phenotypic criterion and one physiological criterion.[10]

In addition, this study also assessed the characteristics of the subjects consisting of gender, age, time of measurement, and various risk factors for ischemic stroke, such as history of active smoking, history of hypertension, history of dyslipidemia, and history of type 2 diabetes mellitus obtained from record data patient medical.

Methods

Data analysis for categorical data was tested with the chi-square test to see if the data was normally distributed with the alternative Fisher's exact test. For numerical data, the p-value was tested with the unpaired t-test if the data was normally distributed with the alternative Mann-Whitney test if the data was not normally distributed. The significance criterion used is the p-value if $p \leq 0.05$ means significant or statistically significant. The Research Ethics Committee of Universitas Padjadjaran approved this study for exemption, with approval number 527/UN6.KEP/EC/2021.

Results

There were 236 subjects, each of which 118 subjects were first and repeat ischemic stroke patients. The majority of research subjects in both groups were male. The average age of first ischemic stroke patients was 56.64 years, with a standard deviation of 14.60. In contrast, the average age of recurrent ischemic stroke patients was slightly higher, 61.75 years, with a standard deviation of 11.36. Measurement of nutritional status was carried out on average on the first day the patient was admitted to the hospital. The majority of patients with both first and repeat ischemic stroke did not smoke, had a history of

hypertension, and had no history of dyslipidemia and type 2 diabetes mellitus (Table 1).

Based on the SGA rating, most first and repeat ischemic stroke patients experienced mild-moderate malnutrition (SGA B). There was a significant difference ($p<0.05$) from the characteristics of patients based on SGA, namely changes in functional capacity and physical examination results, where the characteristics of patients with recurrent ischemic stroke were worse than those of the first ischemic stroke (Table 2). The results of statistical tests on the SGA rating also show the same thing (Table 3).

When viewed from each component of the SGA, the majority of ischemic stroke patients experienced a decrease in nutritional intake. More ischemic stroke patients experienced a decrease in nutritional intake, although there was no significant difference. In addition, most ischemic stroke patients did not experience weight changes, but not a few also experienced weight loss (28.81% of first ischemic stroke and 25.42% of recurrent ischemic stroke). The majority of ischemic stroke patients experience digestive system symptoms, which include nausea, vomiting, diarrhea, decreased appetite or anorexia, dysphagia, constipation, dental problems, pain when eating, and feeling full quickly, with a higher proportion in patients with recurrent ischemic stroke (59.32%). Almost all ischemic stroke patients, both first and repeat, have decreased functional capacity. The results of the physical examination, which included loss of subcutaneous fat muscle mass, as well as the presence of edema and ascites, showed that the majority of ischemic stroke patients did not experience any changes but showed that re-ischemic stroke patients experienced more physical changes (16.10% in the mild-moderate category and 9.32% in the category of mild-moderate stroke) compared with first ischemic stroke patients (9.32% mild-moderate and severe category, Table 2).

Based on BMI, the majority of ischemic stroke patients were in the normal category (62.71% in recurrent ischemic stroke and 56.78% in first ischemic stroke). In addition, 27.97% of first ischemic stroke patients and 22.03% of recurrent ischemic stroke patients were overweight, 4.24% of first ischemic stroke patients, and 5.93% of recurrent ischemic stroke patients were obese. Not a few patients also fall into the category of underweight, namely 11.02% of patients with

Table 1 Research Subjects Characteristics

Characteristics	Ischemic Stroke		p
	First Event n=118 (%)	Recurrent n=118 (%)	
Gender			
Male	60 (50.84)	70 (59.32)	0.028*
Female	58 (49.15)	48 (40.68)	
Age (mean±SD)	56.64±14.60	61.75±11.36	
Time assessment (mean±SD)	1.14±1.53	1.19±1.35	0.106
Smoking			
Yes	28 (23.73)	31 (27.27)	<0.001*
No	81 (68.84)	81 (68.84)	
N/A	10 (8.47)	6 (5.08)	
Hypertension			
Yes	94 (79.66)	107 (90.68)	0.360
No	24 (20.34)	11 (9.32)	
Hyperlipidemia			
Yes	42 (35.59)	48 (40.68)	0.172*
No	76 (64.41)	70 (59.32)	
Type 2 diabetes mellitus			
Yes	32 (27.12)	28 (23.73)	0.083
No	86 (72.88)	90 (76.27)	

Note: *Fisher's exact test

Table 2 Subject Characteristics based on SGA

SGA	Ischemic Stroke		p
	First Event n=118 (%)	Recurrent n=118 (%)	
Nutrition intake			
Good	34 (28.81)	30 (25.42)	0.090
Fair	84 (71.19)	88 (74.58)	
Body weight changes			
Decrease	34 (28.81)	42 (35.59)	0.081*
Increase	2 (1.69)	3 (2.54)	
No change	82 (69.50)	73 (61.86)	
Gastrointestinal problem			
Yes	60 (50.84)	70 (59.32)	0.278
No	58 (49.15)	48 (40.68)	
Functional capacity changes			
Decrease	116 (98.30)	116 (98.30)	0.035
Increase	0 (0)	1 (0.85)	
No change	2 (1.70)	1 (0.85)	
Physical examination changes			
No change	96 (81.36)	88 (74.58)	0.009
Mild to moderate change	11 (9.32)	19 (16.10)	
Severe change	11 (9.32)	11 (9.32)	

Note: *Fisher's exact test

Table 3 Nutrition Status based on SGA

SGA	Ischemic Stroke		p
	First Event n=118 (%)	Recurrent n=118 (%)	
Well-nourished (SGA A)	31 (26.27)	28 (23.73)	<0.001[*]
Mild/moderately malnourished (SGA B)	76 (64.41)	79 (66.95)	
Severely malnourished (SGA C)	11 (9.32)	11 (9.32)	

Note: [*]Fisher's exact test

first ischemic stroke and 9.32% of patients with recurrent ischemic stroke.

The average body mass index in patients with the first ischemic stroke was 23.06 with a standard deviation of 3.87, while in the second ischemic stroke, it was 23.56 with a standard deviation of 4.32. The two groups significantly differed in BMI (p<0.05, Table 4).

Discussion

Based on the results of the study above, it is known that the general characteristics of the research subjects are primarily male, with the average age of the first ischemic stroke patient at 56.64 years and the recurrent ischemic stroke patient at 61.75 years. These results follow the Framingham Study, which showed that based on the frequency of stroke events, men have a higher stroke frequency than women, and as a person ages, the risk of stroke increases.[11] The mean age at a re-ischemic stroke is higher than at first ischemic stroke, according to the study of Zhou et al.,[5] which states that older age is a higher risk for recurrence, in addition to smoking, suffering from diabetes, and others. Most research subjects

have a history of hypertension as a risk factor. High blood pressure causes increased oxidative stress, inflammatory processes, endothelial dysfunction, plaque formation in blood vessels, and the progression of the atherosclerosis process that leads to ischemic stroke.[6]

This study showed that most patients from both groups (first and recurrent ischemic stroke) had mild-moderate malnutrition based on the SGA rating. Several theories and research results explain the pathogenesis of malnutrition due to stroke. First, in one study, it was found that most stroke patients did not meet their caloric needs, i.e., the average caloric intake during their hospital stay was 60% of their estimated average requirement and increased to only 81% at six months afterward.[8] Other studies have also shown the ratio of carbohydrate to protein intake to be associated with National Institutes of Health Stroke Scale (NIHSS) scores. From this study, it was found that protein intake was inversely proportional to the NIHSS score, which indicated an increase in protein intake would lead to an improvement in the condition of post-stroke patients.[6] Stroke patients also experience weight loss due to loss of appetite caused by depression,

Table 4 Nutrition Status based on BMI

BMI	Ischemic Stroke		p
	First Event n=118 (%)	Recurrent n=118 (%)	
Nutrition intake	13 (11.02)	11 (9.32)	<0.001[*]
Body weight changes	67 (56.78)	74 (62.71)	
Gastrointestinal problem	33 (27.97)	26 (22.03)	
Physical examination changes	5 (4.24)	7 (5.93)	
Mean±SD	23,06±3.87	23,56±4.32	
Median	23.11	23.99	
Range (min–max)	16.56–35.80	12.49–39.56	

Note: [*]Fisher's exact test

cognitive deficits, paralysis. Upper extremity, visual and cognitive changes such as hemianopsia and apraxia.[8] Second, associated with dysphagia. Recurrent stroke events often cause dysphagia. Based on a retrospective study of 261 post-stroke patients by Kim et al.,[12] patients with mild and severe dysphagia were malnourished based on levels of albumin, albumin, protein, and lymphocytes. Dysphagia often causes weight loss due to decreased food intake. In addition, dysphagia also often causes discomfort during swallowing, which causes the patient to lose appetite and ultimately leads to malnutrition in hospitalized patients.[8] Chronic or acute deficiency and inflammatory conditions, which can lead to nutritional-related complications, can also reduce muscle mass, resulting in impaired swallowing function recovery after stroke.[13,14]

In addition, malnutrition in stroke patients is usually caused by the inability of the body of stroke patients to tolerate enteral nutrition due to decreased intestinal motility, weak gastrointestinal muscle tone, and impaired excretion of gastrointestinal hormones and enzymes, as well as damage to the intestinal mucous membrane. As a result, nutrient absorption is decreased, and malnutrition occurs. This condition causes inadequate digestion of food and tends to reduce the patient's digestive function.[8,15] Reduced muscle mass in patients with oropharyngeal dysphagia can also lead to worsening of the ability to swallow and can impair swallowing effectiveness.[10] Malnutrition is also associated with location of residence, diabetes mellitus, anorexia, reduced food intake, and reduced preference for sweet and fatty foods.[16]

Most stroke patients in both groups belonged to the normal BMI category. This is in line with the research results of Kartika et al.,[8] who explained that stroke patients majority have a normal BMI. Although obesity is usually associated with hyperlipidemia, hypercholesterolemia, and hypertriglyceridemia, which causes atherosclerosis, which ultimately results in ischemic stroke, the patient's dyslipidemia factors influence the pathogenesis of stroke more than the patient's BMI.

The overall results of comparing the nutritional status of the first and recurrent ischemic stroke patients showed a significant difference (p<0.05), with the nutritional status of the recurrent ischemic stroke patients being worse than the first ischemic stroke. It can happen because, in recurrent ischemic stroke, there are clinical manifestations that appear, such as gastropathy, enteropathy, and impaired swallowing function, compared to malnutrition in the first attack, which is mainly caused by the patient's underlying disease and lack of nutritional intake after the attack. Recurrent stroke is a leading cause of death, re-hospitalization, and long-term disability. Compared with the first stroke, the resulting nerve damage is more serious, more difficult to treat, and has a higher mortality.[5,7] This causes the nutritional status also to be worsened.

The limitations of this study are the type of research that is retrospective and measurements of SGA and BMI are generally only carried out at the time of initial admission to the hospital, so it is difficult to distinguish a decrease in nutritional status caused by a pre-existing disease (underlying disease) or caused by an underlying disease. Clinical manifestations of the patient's current stroke. Future research needs to identify further risk factors that can affect nutritional status in stroke patients outside of stroke types based on the time of occurrence (first and recurrent), especially underlying disease and dietary habits, and it is necessary to carry out a comprehensive nutritional status assessment for stroke patients, especially in recurrent stroke. Appropriate dietary interventions can be implemented to prevent the deterioration of the nutritional status of stroke patients, reduce the risk of secondary complications, shorten the length of stay, and reduce morbidity and mortality.[17,18]

Conclusions

There was a significant difference in the nutritional status of the first and recurrent ischemic stroke patients in terms of patient characteristics based on the results of the SGA examination (decreased functional capacity and physical examination results), SGA rating, and BMI. The nutritional status of recurrent ischemic stroke patients is worse than that of the first ischemic stroke patients.

Conflict of Interest

There is no competing interest.

References

1.   Radu RA, Terecoasă EO, Băjenaru OA, Tiu

C. Etiologic classification of ischemic stroke: where do we stand? Clin Neurol Neurosurg. 2017;159:93-106.

2. Badan Penelitian dan Pengembangan Kesehatan Kementerian Kesehatan Republik Indonesia. Hasil utama Riskesdas 2018 [Internet]. Jakarta: Kementerian Kesehatan Republik Indonesia; 2018 [cited 2022 September 12]. Available from: https://kesmas.kemkes.go.id/assets/upload/dir_519d41d8cd98f00/files/Hasil-riskesdas-2018_1274.pdf.

3. Rizal A. Stroke dan hipertensi [Internet]. Bandung: RSUP Dr. Hasan Sadikin; 2011 [cited 2022 September 20]. Available from: http://web.rshs.or.id/stroke-dan-hipertensi.

4. Escott-Stump S. Nutrition and diagnosis-related care. 8th edition. Philadelphia; Wolters Kluwer; 2015.

5. Zhuo Y, Wu J, Qu Y, Yu H, Huang X, Zee B, et al. Clinical risk factors associated with recurrence of ischemic stroke within two years: a cohort study. Medicine (Baltimore). 2020;99(26):e20830.

6. Kwon SY, Park JH, Kim WS, Han K, Lee Y, Paik NJ. Health-related quality of life and related factors in stroke survivors: data from Korea National Health and Nutrition Examination Survey (KNHANES) 2008 to 2014. PLoS One. 2018;13(4):e0195713.

7. Caplan LR. Caplan's stroke: a clinical approach. 5th edition. Cambridge: Cambridge University Press; 2015.

8. Kartika G, Amalia L, Nugraha GI. Nutritional status of hospitalized stroke patients: assessment by body mass index and subjective global assessment method. AMJ. 2017;4(2):293–8.

9. Reber E, Gomes F, Vasiloglou MF, Schuetz P, Stanga Z. Nutritional risk screening and assessment. J Clin Med. 2019;8(7):1065.

10. Shimizu A, Maeda K, Koyanagi Y, Kayashita J, Fujishima I, Mori N. The global leadership initiative on malnutrition–defined malnutrition predicts prognosis in persons with stroke-related dysphagia. J Am Med Dir Assoc. 2019;20(12):1628–33.

11. Brainin M, Heiss WD. Textbook of stroke medicine. 3rd edition. Cambridge: Cambridge University Press; 2019.

12. Kim SM, Woo HG, Kim YJ, Kim BJ. Blood pressure management in stroke patients. J Neurocrit Care. 2020;13(2):69–79.

13. Lieber AC, Hong E, Putrino D, Nistal DA, Pan JS, Kellner CP. Nutrition, energy expenditure, dysphagia, and self-efficacy in stroke rehabilitation: a review of the literature. Brain Sci. 2018;8(12):218.

14. Nishioka S, Okamoto T, Takayama M, Urushihara M, Watanabe M, Kiriya Y, et al. Malnutrition risk predicts recovery of full oral intake among older adult stroke patients undergoing enteral nutrition: secondary analysis of a multicentre survey (the APPLE study). Clin Nutr. 2017;36(4):1089–96.

15. Zheng T, Zhu X, Liang H, Huang H, Yang J, Wang S. Impact of early enteral nutrition on short-term prognosis after acute stroke. J Clin Neurosci. 2015;22(9):1473–6.

16. Paquereau J, Allart E, Romon M, Rousseaux M. The long-term nutritional status in stroke patients and its predictive factors. J Stroke Cerebrovasc Dis. 2014;23(6):1628–33.

17. Weun CC, Hasnan N, Latif LA, Majid HA. Nutritional status of post-acute stroke patients during rehabilitation phase in hospital. Sains Malays. 2019;48(1):129–35.

18. Ferrie S. What is nutritional assessment? A quick guide for critical care clinicians. Aust Crit Care. 2020;33(3):295–9.