The Differences in the Clinical Outcome Based on Nutritional Status in Patients with Acute Ischemic Stroke in Universitas Gadjah Mada Academic Hospital

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Abstract

Background: The prevalence of stroke in Indonesia according to Basic Health Research (RISKESDAS) 20131 was 7%, increasing to 10.9% in the Basic Health Research. Malnutrition is a kind of complication which stroke patients often experience. Complications that often arise in stroke patients are malnutrition. The impact of hospital malnutrition increases patients' length of stay and disease complications. The purpose of this study is determine the differences in clinical outcomes and length of stay in patients with acute ischemic stroke based on nutritional status at Academic Hospital UGM.

Materials and Methods: The research used a retrospective cohort design with purposive sampling. All respondents were selected because they met the inclusion criteria. The respondents' data were taken from medical records of inpatients at the UGM Academic Hospital from January to December 2019. Data analysis was analyzed by using the Kruskal Wallis test because the data were not normally distributed.

Results: The result showed that stroke was more common in men (54.3%) with an average age of 60-74 years (55.5%). After being hospitalized, most of the patients' condition was improved (89%) with a no-risk screening score (85.5%). The nutritional status in stroke patients is good (44.5%). The length of stay (LOS) of stroke patients mainly was 4-7 days (75.7%) with an average NIHSS score of 5-15 or moderate (47.4%). The statistical test showed a value of p <0.05 to assess the difference in clinical outcomes of LOS and NIHSS scores on nutritional status.

Conclusion: There were differences in clinical outcomes in LOS and NIHSS scores based on the nutritional status of acute ischemic stroke patients. Patients with poor nutritional status had higher LOS and NIHSS scores, followed by normal nutritional status and overweight status.

Keywords: Acute Ischemic Stroke, clinical outcome, nutritional status

1.   Introduction

The prevalence of stroke in Indonesia from the Basic Health Research (RISKESDAS) data in 2013 is 7%, but it increased to 10.9% in 2018[1]. There is a classification of stroke patients. The percentage of male patients is 11%, and female patients are 10.9%, meaning that they have almost the same number. However, in terms of location, the number of patients from urban areas (12.6%) was higher than in rural areas (8.8%)[2].

Stroke is the top ten most common diseases in inpatients at the UGM Academic Hospital. Nutritional problems which often arise in stroke patients are malnutrition. Malnutrition consists of less nutritional status and more nutritional status. Malnutrition in hospitals is a significant challenge in nutritional problems for inpatients[3].

The impacts of malnutrition in hospitals include increasing length of stay, increasing mortality, slowing healing, increasing disease complications, and increasing treatment costs[4]. It will worsen the patient's health condition, where malnutrition contributes to patient morbidity and mortality[5]. A report conducted by the British Association for Parenteral and Enteral Nutrition (BAPEN) showed that malnourished patients some conditions such as a 65% increase in doctor's visits; an 82% for hospital admissions; a 30% length of stay in the hospital, a greater risk to be taken care in nursing homes in their old age[6].

Based on the background, the researcher intends to research differences in clinical outcomes based on nutritional status in acute ischemic stroke patients at Academic Hospital UGM.

2.   Materials and Method

The research used a retrospective cohort design with purposive sampling. The research was conducted for 4 months at Academic Hospital UGM. The minimum number of samples required in this study was 96 respondents.

The inclusion criteria included: patient admissions ranging from January 1 to December 31, 2019, 24 hours minimum for the length of stay of the patient (Length of Stay), formally admitted as an inpatient in a hospital, diagnosed with acute stroke infarction, available NIHSS score data, weight, height, BMI, screening score, length of stay. While the exclusion criteria were: diagnosed as a psychiatric patient, had a history of infectious disease and malignancy, the patient returned from the hospital prematurely or on his request, and the patient died. There are 173 respondents who meet the inclusion and exclusion criteria.

Nutritional status was categorized into three, i.e. less (<18.5 kg/m2), good(18.5-22.9 kg/m2), and more (>=23 kg/m2). LOS data was calculated in the form of a ratio scale. NIHSS data was obtained from the difference in the initial NIHSS score minus the final NIHSS score then divided by the initial NIHSS score. The results were categorized as good if the difference in scores decreased by two or more, while the results were categorized as bad if the scores increased or remain.

The research was conducted in three stages: the preparation stage, the implementation stage, and the analysis and report stage. The preparation stage included licensing and preparing the questionnaires. Then, the implementation stage covered medical record data tracing and data processing and reporting stages. Subject characteristics were analyzed using descriptive analysis. Data nutritional status and LOS analysis was carried out using the Kruskal Wallis test because the data were not normally distributed. Statistical calculation of Nutritional status and NIHSS using *chi square*. Furthermore, it aimed to see differences in clinical outcomes with NIHSS scores based on the nutritional status of patients.

3.   Result

Here is the characteristics of respondents of the study.

Table 1. General characteristics of research subjects

Characteristics	N = 173
Gender	
- Male	94 (54.3%)
- Female	79 (45.7%)
Age	
- Adult (<45 years)	6 (3.5%)
- Young-elderly (45-59 years)	42 (24.3 %)
- Middle-elderly (60-74 years)	96 (55.5%)
- Oldest-elderly (75-90 years)	29 (16.7%)
Post hospitalized condition	
- Recovered	18 (10.4%)

- Improved	154 (89%)
- Referred	1 (0.6%)
Screening score	
- Risky	25 (14.5%)
- Not risky	148 (85.5%)
Nutritional status	
- Less	11 (11%)
- Good	77 (44.5%)
- More	77 (44.5%)
LOS	
- ≤ 3 day	15 (8.7%)
- 4-7 day	131 (75.7%)
- >7 day	27 (15.6%)
Intial NIHSS Score	
- 0 non stroke	0 (0%)
- <=4 minor	83 (47.9%)
- 5-15 moderate	78 (45%)
- 16-20 moderate severe	10 (5.7%)
- 21-42 severe	2 (1.1%)
Final NIHSS Score	
- 0 non stroke	13 (7.5%)
- <=4 minor	69 (39.8%)
- 5-15 moderate	82 (47.3%)
- 16-20 moderate severe	6 (3.4%)
- 21-42 severe	3 (1.7%)

Most of the participants were male, with the number of 94 people (54.3%).

Table 2. Statistical calculation of LOS and nutritional status

Variable	*Length of Stay*		p
	n	Mean±SD	
Nutritional status			0,000
Less	19 (11%)	8.89±4.14	
Good	77 (44.5%)	5.93±3.51	
More	77 (44.5%)	5.83±3.02	

Patients who have an average LOS of 4-7 days are 75.7%.

Table 3. The Results of NIHSS Statistical Analysis and Nutritional Status

Variable	NIHSS		p
	n	Mean±SD	
Nutritional Status			0,019
Less	19 (11%)	-0.05±0.35	
Good	7 (44.5%)	0.12±0.49	

More	7 (44.5%)	0.13±0.54

In the statistical analysis of the table above, it was sfound that there was a significant difference between the NIHSS score and nutritional status (p<0,05). The less nutritional status of the pastient, the lower improvement in the NIHSS score at the end of treatment.

Table 4. Results of statistical analysis of nutritional status by age

Variabel	Status Gizi		p
	n	Mean±SD	
Age			0,000
Young adult	6 (3.5%)	25.56±4.38	
Mature adult	42 (24.3%)	24.28±3.54	
Young elderly	96 (55.5%)	22.69±3.57	
Old elderly	29 (16.8%)	19.73±3.90	

The research showed a significant difference between age and nutritional status (p <0.05). The higher the age, the nutritional status tends to decrease.

Table 5. The Results of Comorbid Statistical Analysis with Nutritional Status and LOS

Variable	Nutritional Status		p	LOS	p
	n	Mean ±SD		Mean±SD	
Comorbid					
None	110 (63.6%)	22.76±3.88	0,305	5.73±2.84	0.03
DM	34 (19.7%)	23.24±3.56		5.55±1.92	
Pneumonia	7 (4%)	21.55±4.78		9.14±7.47	
Heart disease	12 (6.9%)	22.97±4.40		8.25±3.57	
>1 diseases	10 (5.8%)	20.36±4.33		9.2±6.49	

The research found no significant difference between comorbidities and nutritional status

(p>0.05). Moreover, the results showed that 63.6% of the subjects did not have comorbid diseases. It is because most stroke patients have hypertension.

4. Discussion

Men are more prone to stroke than women because women have the hormone estrogen that can protect women until the period of childbearing[7]. The highest number of patients in this study were patients with the elderly (60-74 years) at 55.5%. The incidence of stroke at 55 years is higher than the age of 40-55 years. The incidence doubles every decade after the age of 45. Thus, more than 70% of all strokes occur over the age of 65[8].

The condition of the patient's discharge was improved by 89%. In addition, as many as 10.4% of patients were declared cured. The number of patients with a screening score was not at risk of 85.5%, while 14.5% of patients were at risk of malnutrition. This research also obtained results that the average nutritional status of patients is good at 45%. The nutritional status is less than 10.9%, while patients with more nutritional status are 44.1%.

The length of stay of long-stroke patients will result in more significant treatment costs, an increase in the occurrence of infections that patients get during treatment, especially in elderly patients, death of patients in hospital and is also associated with poor outcomes in patients[9].

The data obtained from the initial NIHSS examination of most patients had minor stroke (47.9%), followed by a moderate scale of 45%, moderate severe 5.7%, severe 1.2%, and no stroke 0%. Meanwhile at the final NIHSS examination, the highest data was found in the moderate group at 47.3%, followed by a minor NIHSS score of 39.8%, no stroke 7.5%, moderate severe 3.4%, and severe 1.7%. It can be seen that there was a decrease in the percentage of NIHSS scores in the moderate, severe, and minor categories, as well as an increase in the NIHSS score in the non-stroke category. This indicates an improvement in the NIHSS stroke at the end of treatment. National Institutes of Health Stroke Scale (NIHSS) has been shown to accurately determine stroke severity

and prognosis in the context of clinical practice and clinical trials.

Based on the statistical calculation, it showed that there was a difference between nutritional status and *Length of Stay* (p<0,05).

Patients with poor nutritional status have a longer length of stay when compared to normal nutritional status. Poor nutritional status affects a decrease in the body's immunity. It makes patients susceptible to complications and infections, which result in prolonging the healing process and length of hospitalization. Good nutritional status in hospitalized patients could improve patient response to therapy, reduce the incidence of infection, complications, and shorten recovery time[10]. The longer a person is hospitalized, the more it will affect his physiological condition. The longer the patients stay in bed, the more a person will experience muscle atrophy due to lack of movement. Muscle atrophy causes muscle loss which means that it affects the healing process and length of hospitalization. Malnutrition in hospitalized patients resulted in the recovery of the healing process and the length of stay itself.

Patients with more nutritional status have a low risk of the length of stay. It is because better nutritional status has a protective effect. It may predominate in dangerous metabolic disorders that are usually found in overweight status.

Previous studies about the population obtained a U-shaped relationship between BMI and stroke and all causes of death in acute ischemic stroke patients. Higher BMI (but below 31 kg/m2) has a protective relationship. However, BMI > 38 kg/m2 is associated with high mortality[11].

However, the effect of obesity on ischemic stroke outcomes is still unclear. Many previous studies have shown a better prognosis in obese patients after a stroke, or what can be called the "obesity paradox." However, it does not mean that fatter is better or "the fatter, the better." Many things need to be analyzed further regarding the risk factors for other conditions that influence death. Several mechanisms of stroke include stress-associated neuroendocrine, autonomic nervous activation, pro-inflammatory cytokines, increased oxygen free radical load, and systemic hormonal imbalance, increasing the overall catabolic state.

Thus, obese patients with better metabolic reserves may be less affected by this unfavorable metabolic dysregulation than underweight patients[12].

Nutrition plays an essential role in the regeneration of brain cells and their physiological functions, such as the conduction of nerve impulses and connections between neurons. There is high oxidative stress in stroke conditions which will trigger cell damage. The presence of antioxidants can act as protection to prevent further damage. In stroke patients with poor nutritional status, macro and micronutrients are not sufficient to improve the clinical condition of the stroke to affect the degree of severity.

Recurrent stroke is closely related to the possibility of worse severity due to a history of neurological deficits in previous strokes. The neurological deficit causes a decrease in the subject's independence to eat, affecting the nutritional status of stroke patients. Stroke cases treated in hospitals with malnutrition conditions are very high in prevalence[13].

Elderly people need to be aware of the decrease in nutritional status, which gave the high prevalence of malnutrition for about 10-50%. Another factor that can affect the health of the elderly is because elderly people often experience chronic diseases. Elderly people who experience poor nutritional status can cause various physical health problems that can interfere with daily activities[14].

Hypertension is a risk factor for stroke. The most comorbid suffered from stroke patients was diabetes mellitus, which was 19.7%. A study regarding predictors of not achieving blood pressure targets in acute hemorrhagic stroke patients[15]. It showed that most stroke atients had diabetes mellitus comorbid compared to cardiovascular comorbidities.

Diabetes Mellitus increases the risk two to three times for the occurrence of stroke, both first stroke, and stroke again. DM has also been reported as an independent factor of death in patients suffering from a stroke. Hyperglycemia that accompanies acute stroke can increase brain damage due to endothelial nitric oxide (eNOS) dysfunction. Moreover, it can cause oxidative stress, vasoconstriction of cerebral blood vessels, and leukocyte adhesion that causes microvascular blockage. Tight control of blood glucose levels is associated with reduced mortality in critically ill stroke patients[16].

In this research, it was found that there was a significant difference between comorbidities and LOS ($p<0.05$). Based on the LOS distribution of complications in stroke patients, the result showed that the number of stroke patients with complications had fewer. Moreover, stroke patients with complications had a higher average LOS. Patients with comorbid >1 disease experienced the highest LOS. Meanwhile, the second-highest LOS was experienced by patients with comorbid pneumonia. Stroke patients with heart disease, diabetes mellitus, and hypercholesterolemia are likely to experience slower clinical improvement than patients who do not have the diseases[17].

Infection is the most common complication in stroke patients. Moreover, it has a significant influence on prognosis, length of stay, and cost of hospitalization. On the other hand, pneumonia has been proven to be a significant cause of early morbidity and mortality and increased length of stay and cost of treatment in hospitalized acute stroke patients. Thus, early identification of stroke patients with a high risk of pneumonia can help doctors prevent it from occurring in stroke patients during hospitalization[18].

5.   Conclusion

There were differences in clinical outcomes in the length of stay and NIHSS scores based on the nutritional status of acute ischemic stroke patients. Patients with poor nutritional status had higher LOS and NIHSS scores. Moreover, it was followed by normal nutritional status and overweight status.

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