

# Evaluation methods on the nutritional status of stroke patients

J. WANG, B. LUO, Y. XIE, H.-Y. HU, L. FENG, Z.-N. LI

Department of Nutrition, The First Hospital of Hebei Medical University, Shijiazhuang, China

**Abstract. – OBJECTIVE:** This study was designed to assess the effect of particular tools on the nutritional status of patients with stroke risk factors; to analyze these risk factors; to construct an assessment table; and to enable nurses to conduct fast and accurate assessment of the nutritional status of patients with stroke.

**PATIENTS AND METHODS:** Various nutritional assessment tools were employed to assess the nutritional status of stroke patients [(Nutritional Risk Screening 2002, NRS2002); (mini nutritional assessment, MNA), (subjective global assessment SGA), (malnutrition universal screening, MUST); (body composition, BCA)]. The leading disease-related factors of cerebral apoplexy were observed in patients with malnutrition. And a statistical analysis was conducted.

**RESULTS:** The significant risk factors of cerebral apoplexy in malnourished patients older than 70 years were swallowing dysfunctions, disturbance of consciousness and reliance or half-reliance on feeding practices. The significant risk factors of malnutrition in patients with cerebral apoplexy were the decline in upper limb muscle strength, decline in the performance of various activities, loss of appetite and gastrointestinal symptoms.

**CONCLUSIONS:** Disorders that affect the nutritional status of stroke patients can be used as evaluation tools, as described in the evaluation table. The clinical relevance of this study includes the following: to enable the clinical nursing staff to easily assess the patient's nutritional status in a timely manner; to improve compliance with nutritional evaluation; to provide clinical nutrition support to patients with stroke; and to provide a scientific basis for the improvement of the clinical outcomes of patients with cerebral apoplexy.

*Key Words:*

Stroke, Nutritional status, Nutritional assessment.

## Introduction

The incidence of malnutrition that commonly affects patients with stroke is 8 to 49%<sup>1</sup>. In these

patients, cerebral apoplexy causes various changes, such as swallowing dysfunction, hemiplegia, cognitive impairment, post-stroke depression and symptoms of nerve function damages, which directly lead to eating difficulties, poor nutrient intake, infection, fever and other complications. These changes increase the catabolism of the body and, therefore, the nutritional status of patients get worse. The degree of their nerve function defects and malnutrition affect prognosis, especially the patients with three-month-old independent risk factors and greater malnutrition risk coefficients<sup>2,3</sup>. In 2004 in Australia, Davis et al<sup>4</sup> found that the admission of patients with acute stroke and malnutrition was 16.2%, which is associated with a mortality of one month (OR = 3.2,  $p = 3.2$ ) after factors were adjusted for age, severity of stroke and previous functional condition. In 2005, an international multicenter randomized controlled clinical study on feed or ordinary diet showed that the nutritional deficiencies in patients with acute stroke with poor prognosis (aside from increased mortality, pneumonia, gastrointestinal bleeding, incidence of pressure ulcers and other infections and complications) were significantly higher than the control group<sup>5,6</sup>. Nutritional disorders are associated with significantly adverse outcomes of stroke and mortality. These disorders also increase the occurrence of malnutrition in patients with cerebral apoplexy; therefore, nutrition management has become an important part of the comprehensive treatment for stroke. As early as 2005, the American guidelines for stroke<sup>7</sup> required a baseline nutrition assessment of all patients with cerebral apoplexy and the correction or improvement of the nutritional status of the patients. Released in 2007, the expert consensus on the nutrition management of patients with stroke in the People's Republic of China<sup>8</sup> clearly articulated that the nutrition management (acute phase and convalescence) of patients with stroke should be considered as a part of overall management.

Nutritional assessment is the first and most important step in the process of nutrient management<sup>9-12</sup>; however, this process is also easily ignored by medical staff. Studies have shown that no nutritional screening can be implemented properly if simple and effective screening tools are insufficient<sup>13,14</sup> and if there is no agreement among personnel that can implement the nutritional screening<sup>15</sup>. Currently, many types of nutritional screening methods are used, each with its own advantages and limitations. However, in cerebral apoplexy patients, targeted nutritional assessment tools remain insufficient. This study analyzed the factors that affect the nutritional status of patients with cerebral apoplexy in addition to a comparative review of current approaches used for nutritional evaluation (Nutritional Risk Screening 2002 – NRS2002<sup>16</sup>, Mini Nutritional Assessment – MNA<sup>17,18</sup>, Subjective Global Assessment – SGA<sup>19</sup>, Malnutrition Universal Screening Tool – MUST, Body Composition Analysis – BCA). The objectives of this study include the following: to determine the sensitive factors that affect the nutritional status of cerebral apoplexy patients; to assess and tabulate their nutritional conditions; to enable the clinical nursing staff to easily assess the patient's nutritional status in a timely manner; to improve compliance with nutritional evaluation; to provide clinical nutrition support for patients with stroke; and to provide a scientific basis for improving clinical outcomes of patients with cerebral apoplexy.

## Patients and Methods

### *Ethical Aspects*

Our investigation complies with the standards of the Helsinki Declaration concerning investigation with human subjects. The study was approved by the First Hospital of HeBei Medical University Ethical Committee. All participants signed an informed consent form prior to participation in the study.

### *Sample and Methods*

The study sample included patients from the First Hospital of HeBei Medical University. Patients were admitted for a stroke during October 2011 to September 2012, and their treatment lasted for more than three months. An Ethical Committee at the First Hospital of HeBei Medical University approved this research project, reference number is 20130010. All the patients and their families gave informed consent. The pa-

tients included 118 males and 83 females (average age: 62 years, QR = 21 years old).

The study methods consisted of the following: Various nutritional evaluation tools (NRS2002 and MNA, SGA, MUST and BCA) were employed in the nutritional assessment of selected patients. Additionally, the following were observed in the patients: vital signs, activity, depression, stress, states of the body, swallowing function, consciousness, intracranial pressure, abdominal distention, diarrhea, constipation, upper limb muscle strength, facial paralysis, edema or ascites, pressure ulcers, among others. The following factors were also investigated: protein intake, daily water consumption, feeding mode and appetite. These conditions can result in malnutrition symptoms associated with the disease.

The following measures were followed to assure quality control. Trained personnel collected the data. They collected data for the first 24 h of admission, on the seventh day for 24 h and 1 day before discharge. The experiment was conducted on scales before correction. Urine analysis was done when patients had an empty stomach in the morning. Patient's weight was measured with clothes on. The measurements for the triceps and arm muscle circumference were recorded three times and averaged. The American Beckman Coulter Ter UniCelDxC 800, a large automatic biochemical analyzer (Beckman Coulter Inc., Brea, CA, USA), was used to measure serum albumin. The American Beckman LH750 blood composition analyzer was used to determine the total lymphocyte count.

### *Statistical Analysis*

Data were analyzed using SPSS 16.0 (SPSS Inc., Chicago, IL, USA), and the  $\chi^2$  test and linear trend analysis were used.

## Results

The nutritional evaluation results showed the distribution of nutrition status risk factors of both normal and malnourished groups. Malnutrition was shown to affect the distribution of nutrition status risk factors of patients with cerebral apoplexy.

The assessment of SGA was applied to assess the nutritional status of the patients, including the modes of feeding in both the normal and malnourished groups, which showed a significant difference ( $p = 0.027$ ). Application MUST was used to assess the data and yielded the following

statistically significant results in the normal and malnourished groups: activity ( $p = 0.015$ ), abdominal distention ( $p = 0.045$ ), decreased upper limb muscle strength ( $p = 0.012$ ), feeding ( $p < 0.001$ ) and appetite ( $p = 0.036$ ). The assessment of MNA was also performed and following statistically significant results in both the normal and malnourished groups were found: activity ( $p < 0.001$ ), neural psychological factors ( $p = 0.002$ ), decreased upper limb muscle strength ( $p < 0.001$ ), feeding ( $p < 0.001$ ), appetite ( $p < 0.001$ ) and protein intake ( $p = 0.021$ ). The assessment of NRS2002 was used to assess the nutritional status of patients and produced following statistically significant results in the normal and malnourished groups: psychological factors ( $p < 0.001$ ), constipation ( $p = 0.005$ ), upper limb muscle ( $p = 0.027$ ), edema and ascites ( $p < 0.001$ ) and mode of feeding ( $P = 0.039$ ). The human nutritional evaluation method was applied to assess the nutritional status of the patients and yielded following statistically significant results in the normal and malnourished groups: constipation ( $p = 0.003$ ), intracranial pressure ( $p = 0.033$ ), feeding ( $p = 0.023$ ) and appetite ( $p = 0.028$ ). These results are shown in Table I.

**Effect on the Nutritional Status of Patients with Stroke Risk Factors and the Linearity of Nutritional Evaluation Results**

The various risk factors and SGA assessment results showed that the linear relationship between upper limb muscle strength decline ( $\chi^2 = 4.382$ ,  $p = 4.382$ ) and the dependency or half-reliance on

the mode of feeding ( $\chi^2 = 11.682$ ,  $p = 11.682$ ) have a tendency to aggravate malnutrition. The MUST results showed that the linear relationships among the decline in upper limb muscle strength ( $\chi^2 = 7.14$ ,  $p = 7.14$ ), dependency or half-reliance on mode of feeding ( $\chi^2 = 23.482$ ,  $p < 23.482$ ), poor appetite ( $\chi^2 = 5.404$ ,  $p = 5.404$ ) and decreased activity ( $\chi^2 = 25.899$ ,  $p < 0.001$ ) also aggravated malnutrition. The advantage and MNA assessment results showed that the linear relationships among the decline in upper limb muscle strength ( $\chi^2 = 22.002$ ,  $p < 22.002$ ), dependency or half-reliance on mode of feeding ( $\chi^2 = 54.063$ ,  $p < 0.001$ ), insufficient protein intake ( $\chi^2 = 7.004$ ,  $p < 7.004$ ), poor appetite ( $\chi^2 = 8.936$ ,  $p = 8.936$ ), decreased activity ( $\chi^2 = 89.992$ ,  $p < 89.992$ ) and neuropsychological symptoms ( $\chi^2 = 5.821$ ,  $p < 0.016$ ) aggravated malnutrition. The NRS2002 assessment results showed that the linear relationships among the neuropsychological symptoms ( $\chi^2 = 21.883$ ,  $p < 21.883$ ), constipation ( $\chi^2 = 12.774$ ,  $p < 0.001$ ), edema or ascites ( $\chi^2 = 12.276$ ,  $p < 12.276$ ), dependency or half-reliance on mode of feeding ( $\chi^2 = 5.374$ ,  $p = 5.374$ ), poor appetite ( $\chi^2 = 6.298$ ,  $p = 0.012$ ) and age ( $\chi^2 = 76.146$ ,  $p < 0.001$ ) aggravated nutritional risks. These results are listed in Table II.

According to the results, the nutritional status tables used in the nursing nutritional status of patients with stroke are as follows:

- A: Age > 70 years old
- Swallowing dysfunction
- Disturbance of consciousness
- Dependence (or half-reliance) on the mode of feeding

**Table I.** Distribution of risk factors between the normal and malnourished groups of stroke patients.

Risk factors (Below normal)	p values				
	SGA	MUST	MNA	NRS2002	BCA
Ability	0.308	0.015	<0.001	0.901	0.227
Neuropsychological factors	0.33	0.267	0.002	<0.001	0.797
Abdominal distension	0.283	0.045	0.934	0.175	0.618
Diarrhea	0.209	0.081	0.585	0.107	0.550
Constipation	0.194	0.157	0.294	0.005	0.003
Swallowing disorder	1.000	0.277	0.294	0.423	0.191
Intracranial pressure	1.000	0.290	0.324	0.370	0.033
Upper limb muscle strength	0.068	0.012	<0.001	0.027	0.533
Facial paralysis	1.000	0.545	0.105	0.567	0.714
Edema /ascites	1.000	0.703	0.760	<0.001	0.331
Mode of feeding	0.027	<0.001	<0.001	0.039	0.023
Appetite	1.000	0.036	<0.001	0.107	0.028
Protein intake	0.509	0.446	0.021	0.639	0.775

**Table II.** Linear relationship between various risk factors and the results of the nutrition assessment tools.

Risk factors (Below normal)	SGA		MUST		MNA		NRS2002	
	$\chi^2$	<i>p</i>	$\chi^2$	<i>p</i>	$\chi^2$	<i>p</i>	$\chi^2$	<i>p</i>
Ability	5.700	0.017	25.899	<0.001	89.992	<0.001	1.604	0.302
Neuropsychological factors	0.147	0.701	1.227	0.268	5.821	0.016	21.883	<0.001
Abdominal distension	1.635	0.201	2.78	0.098	0.007	0.933	2.301	0.129
Diarrhea	2.865	0.091	1.72	0.19	0.140	0.708	2.259	0.133
Constipation	3.188	0.074	2.963	0.085	0.274	0.600	12.774	<0.001
Swallowing disorder	0.055	0.814	1.18	0.277	2.611	0.106	2.38	0.123
Intracranial pressure	0.596	0.440	1.769	0.183	0.855	0.355	0.695	0.404
Upper limb muscle strength	4.382	0.036	7.141	0.008	22.002	<0.001	0.754	0.385
Facial paralysis	0.116	0.733	0.968	0.325	2.969	0.085	0.903	0.342
Edema/ascites	0.273	0.601	0.296	0.586	0.001	0.970	12.276	<0.001
Mode of feeding	11.682	0.001	23.482	<0.001	54.063	<0.001	5.374	0.015
Appetite	1.132	0.287	5.404	0.02	8.936	0.003	5.298	0.012
Protein intake	0.001	0.974	0.783	0.376	7.004	0.008	0.106	0.745

- B: Upper limb muscle strength decline
- Decreased activity
- Loss of appetite
- Gastrointestinal symptoms

Assessment: as shown above, patients with stroke who exhibited; A project item 1 positive or B project item 2 positive are at risk of malnutrition. Their doctor and nutritionist were notified immediately. If patients with stroke exhibited B project item 1 factor, they were provided with the corresponding clinical nutrition guidance, education, targeted treatment and nursing measures.

### Discussion

The nutritional metabolic function of patients with cerebral apoplexy is influenced by various factors that easily lead to nutritional deficiencies. Nutritional deficiencies result in the poor prognosis of patients with cerebral apoplexy. Nutrition management has become an important part of the comprehensive treatment of cerebral apoplexy and is the first and the most important step. Therefore, studies that formulate appropriate nutrition assessment tools are very important for the nutritional management of patients with cerebral apoplexy.

Obstacles to swallow and the disturbance of consciousness caused by stroke may lead to reduced ingestion, protein malnutrition and metabolic disorders. In this study, no statistical significance was found in the swallowing dysfunction of both normal and malnourished groups. The

main reason could be that swallowing dysfunction is easy to focus on. The patient with swallowing dysfunction can be treated early on with the targeted intervention.

NRS2002 lists the age factor only. The category “> 70 years old” is assigned 1 point. In the severity of the disease project, a stroke is listed as two points, based on the age of the independent risk factors of the nutritionally at-risk patients with cerebral apoplexy. Previous studies showed that the independent risk factors of malnutrition in older patients appear after two weeks<sup>20,21</sup>.

The decline of upper limb muscle strength and dependence on the mode of feeding seriously affect the eating habits of the patients<sup>22-24</sup>. In this study, MNA, MUST and NRS2002 evaluation results showed that the difference between the decrease in the upper limb strength of the normal group and the malnourished group were statistically significant. In all the nutritional evaluation tools, the difference between the dependence on the mode of feeding of the normal group and the malnourished group was statistically significant. The decline in the upper limb muscle strength can be compensated for by training the contralateral limb function. However, this decline can still have a large gap, and depends on the mode of feeding, which directly influences the patient’s eating habits. Therefore, reliance on the mode of feeding is an important factor that affects the nutritional status of patients with cerebral apoplexy. The decline in upper limb muscle strength is one of the main factors.

For patients with cerebral apoplexy, a decline in activity affects nutrient intake<sup>25</sup> and can also

result in gastrointestinal dysfunctions, such as gastric paralysis and intestinal obstruction caused by disorders of digestion, absorption, or metabolism. In this study, the MNA and MUST evaluation results showed that the difference between the distribution of the normal group and the malnourished group was statistically significant. In the evaluation content of MNA, the capacity for activity was appointed a specific score. However, medical staff often ignores the activity of malnourished patients; therefore, timely interventions are not administered. In the MUST analysis, reduced food intake exhibited higher scores, demonstrating that the activity is the main factor that causes malnutrition in patients with cerebral apoplexy.

The MNA, MUST and BCA evaluation results showed that the difference between the distribution of decreased appetite in the normal group and the malnourished group was statistically significant. Moreover, the linear relationship analysis of the nutritional evaluations showed that the loss of appetite can aggravate malnutrition<sup>26,27</sup>. Neural endocrine disorders in patients with stroke cause high-stress decomposition and synthesis metabolism imbalance<sup>28</sup>, leading to a loss of appetite, slow digestion and absorption and increased metabolism. Depression also affects a patient's appetite and may cause him or her to eat less<sup>29</sup>. The MNA and NRS2002 results showed that the difference between the distribution of neural psychological factors in the normal group and the malnourished group was statistically significant. Therefore, regardless of the reason, loss of appetite is the leading cause of malnutrition in patients with cerebral apoplexy.

The MUST, NRS2002 and BCA results showed that the difference between the distribution of gastrointestinal symptoms in the normal group and the malnourished group was statistically significant. Each type of gastrointestinal symptoms, such as abdominal distention, diarrhea and vomiting, can lead to a decrease in nutrient intake<sup>30</sup>. Therefore, these symptoms are the main factors that influence the nutritional status of patients with cerebral apoplexy.

Assessment of design and application: according to the above analysis and the results in patients aged <70 years, swallowing dysfunction, disturbance of consciousness and mode of feeding are the important risk factors that lead to malnutrition in patients with cerebral apoplexy. Decrease in upper limb muscle strength, reduced activity, loss of appetite and gastrointestinal symp-

oms are the leading causes of malnutrition in patients with cerebral apoplexy risk factors. The effect of depression on malnourished patients with stroke is also significant, but the main expression is a depressed mood caused by the loss of appetite. The reasons for the loss of appetite in patients who exhibit such symptoms should be investigated, and the corresponding intervention measures should be targeted.

According to the design of the assessment, nurses can quickly judge if patients are at a risk of malnutrition or if they need nutritional support. The proposed design provided a scientific and effective basis for the assessment of patients with cerebral apoplexy. Additionally, the design provided targeted and improved nutrition measures that can enhance the nutritional status and clinical outcomes of patients with cerebral apoplexy based on individual characteristics.

## Conclusions

Both NRS2002 (34.3%) and MUST (33.8%) can be used to screen for malnutrition risk in patients with stroke. The variation in assessment among various personnel was low. MNA is appropriate for individuals who are older than 65 years and have a longer duration of cerebral apoplexy.

The significant risk factors of cerebral apoplexy in malnourished patients aged older than 70 years are swallowing dysfunction, disturbance of consciousness and mode of feeding. The significant risk factors of malnutrition in patients with cerebral apoplexy are the decline in upper limb muscle strength, decline in the performance of various activities, loss of appetite and gastrointestinal symptoms. These disorders that affect the nutritional status of patients with stroke-related factors can be used as evaluation tools.

This study is clinically relevant because the findings can enable clinical nursing staff to easily assess the patient's nutritional status in a timely manner; improve compliance with nutritional evaluation; provide clinical nutrition support for patients with stroke; and provide a scientific basis for improving clinical outcome of patients with cerebral apoplexy.

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## Conflict of Interest

The Authors declare that they have no conflict of interests.

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