ORIGINAL RESEARCH

Influence of Nutritional Status on Prognosis of Stroke Patients With Dysphagia

Ting Liu, MN; Li-ying Wu, BN; Xiao-mei Yang, BN; Yao Chen, BN; Xue-jiao Du, BN; Xue-dan Luo, MM; Jin Zhou, MD; Yi Sui, MD; Wen-ting Zhu, MD

ABSTRACT

Context • Stroke is an acute cerebrovascular disease and a neurological disorder that occurs due to a cerebral arterial embolism and rupture. Acute stroke is often accompanied by dysphagia, which reduces patients' intake of food and nutrients, decreases their nutritional status, and affects their quality of life.

Objective • The study intended to identify the demographic and clinical characteristics of stroke patients with dysphagia and to explore the relationship of those characteristics to nutritional status and prognosis.

Methods • The research team retrospectively collected the clinical data of patients to compare the nutritional status and prognoses of patients with different demographic and clinical characteristics.

Setting • The study took place in the Department of Neurology at the First People's Hospital of Shenyang in Shenyang, China.

Participants • Participants were 789 stroke patients with dysphagia who had been admitted to the general ward of the neurology departments of hospitals of Grade 3 or higher in Northeast China between January 2019 and September 2020. Based on the results of the Nutrition Risk Screening (NRS-2002) and Subjective Global Assessment (SGA) scales at baseline, participants were enrolled in this study.

Outcome Measures • The outcomes were the correlations between participants' demographic and clinical characteristics and their nutritional statuses and prognoses. The Modified Rankin Scale (mRS) was used to evaluate the prognosis of the patients at seven days and three months after participants' enrollment in the study. Using the SPSS 26.0, a *t* test, chi-square test, and F test were performed to analyze and verify the presence of fundamental differences in baseline characteristics between participants with good nutrition and those with poor nutrition. Also, a statistical correlation analysis was performed.

Results • The study showed that participants with different nutritional levels had statistically significant differences in the presence or absence of infections and body temperature and scores on the Standardized Swallowing Assessment (SSA) and National Institutes of Health Stroke Scale (NIHSS), with all $P < .001$. At baseline seven days after enrollment, the prognoses of participants were significantly different for different previous histories of stroke ($P < .001$), family history of stroke ($P = .005$), presence or absence of infections ($P < .001$), body temperature ($P < .001$), and SSA ($P < .001$) and NIHSS ($P < .001$) scale scores. At three months after enrollment, the prognoses of participants were significantly different for previous history of stroke ($P = .003$), different body temperatures ($P < .001$), presence or absence of infections($P < .001$), and SSA ($P < .001$) and NIHSS ($P < .001$) scale scores. Age, gender, family history of stroke, smoking, alcohol consumption, previous history of stroke, education level, SSA scale score, NIHSS scale score, body mass index (BMI), body temperature, and infection were adjusted in the model. Nutritional status as classified by NRS-2002 and SGA was significantly correlated with prognosis ($P < .001$). The prognosis of stroke patients with dysphagia was associated with nutritional status by unconditional logistic regression.

Conclusion • The prognosis of stroke patients with dysphagia is related to their nutritional status. A better nutritional status indicates the better prognosis, and vice versa. In clinical treatment, attention should be paid to use of a nutritional intervention. (*Altern Ther Health Med.* 2022;28(7):26-33).

Ting Liu, MN; chief superintendent nurse, secretary of the party committee; **Li-ying Wu, BN;** chief superintendent nurse, director of nursing department; **Xiao-mei Yang, BN;** chief superintendent nurse, nursing supervisor; **Yao Chen, BN;** deputy chief superintendent nurse, nursing supervisor; **Xue-jiao Du, BN;** deputy chief superintendent nurse, nursing supervisor; **Xue-dan Luo, MM;** chief physician, director; **Jin Zhou, MD;** chief physician, director; **Yi Sui, MD;** chief physician, director; **Wen-ting Zhu, MD;** deputy chief physician, physician; Department of Neurology, the First People's Hospital of Shenyang, Shenyang, Liaoning Province, China.

Corresponding author: Li-ying Wu, BN
E-mail: wuliying202108@163.com

The aging of the population has been accelerating in China, with a resulting increase in the incidence of various diseases. Stroke is an acute cerebrovascular disease and a neurological disorder that occurs due to a cerebral arterial embolism and rupture. As a common, chronic, nervous-system disease, stroke is characterized by high morbidity and rapid onset. It can seriously affect an individual's normal life and even is life-threatening in severe cases.[1] It's also a disease with a high fatality rate.[2]

Acute stroke is often accompanied by dysphagia, accounting for over 50% of people affected.[3] This concomitant symptom occurs because the disease damages patients' brain-nerve conduction bundles. Accordingly, it affects the motor functions of the larynx, pharynx and tongue muscles, resulting in patients' inability to transfer food from the mouth to the stomach and in clinical symptoms such as bucking, dysdipsia, and aspiration.

In severe cases, multiple organ failure and nutritional disorders can also be present. Currently, the mechanism of stroke with dysphagia remains unclear and is probably related to injury of the glossopharyngeal nerve, bilateral corticobulbar tract, and vagus nerve.[4] Relevant clinical studies have shown that about 40% of stroke patients with dysphagia will develop unilateral lesions of the cerebral hemisphere, especially on the right side.[5]

Concomitant dysphagia reduces patients' intake of food and nutrients; decreases their nutritional status, increasing the incidence of malnutrition and aggravating existing malnutrition; and affects their quality of life.[6-8] Because stroke patients are always bedridden for a long time, their family members are mainly responsible for their daily lives, which can reduce patients' self-care ability and social function and can adversely affect their prognoses.[9]

In recent years, researchers have investigated the benefits of nutritional interventions for stroke patients with dysphagia; however, nursing methods have been the focus of most studies. In some studies, a significant association has been found between nutritional support and beneficial outcomes.[10] Some clinical studies have shown that improving the nutritional status of stroke patients with dysphagia can reduce the incidence of complications and improve neurological function, thus improving the prognosis.[11-2]

One study has demonstrated that evidence-based treatment protocols can effectively reduce the fatality rate for patients.[13] The Nutrition Risk Screening (NRS-2002) scale conforms to the tenets of evidence-based medicine and is a commonly used tool for nutritional risk screening.[14] This measurement tool can predict the risk of malnutrition according to a patient's disease condition, age, and nutritional status. A score of <3 points on the scale indicates the possibility that an nutritional intervention can be effective for a patient. The tool also has other advantages, such as acting as a simple, dynamic evaluation method, which offers time-sensitive and pertinent evaluation results.

Another useful tool is the Subjective Global Assessment (SGA) scale, which is a simple assessment method based on a doctor's experience and subjective analysis of a patient's nutritional status. Nutritional grade is determined in combination with the subjective judgment of medical staff, who can assess various indicators of patients using the SGA scale and divide them into three levels: A, B, and C. More A levels indicate a better nutritional status, while more B and C levels indicate a worse nutritional status.

To provide a more-scientific basis for further interventions for stroke patients with dysphagia, the current study intended to identify the demographic and clinical characteristics of stroke patients with dysphagia and to explore the relationship of those characteristics to nutritional status and prognosis.

METHODS

Participants

The research team retrospectively collected the clinical data of 2000 patients who had had an acute ischemic stroke and who had been admitted to the general ward of the neurology departments of hospitals of Grade 3 or higher in Northeast China between January 2019 and September 2020. The baseline data were collected within seven days of enrollment.

Potential participants were included if they: (1) met the relevant criteria of *Chinese Guidelines for Diagnosis and Treatment of Acute Ischemic Stroke 2010*,[15] with the stroke having been confirmed by a computerized tomography (CT), magnetic resonance imaging (MRI), or diffusion-weighted imaging (DWI) scan and (2) had dysphagia.

Potential participants were excluded if they: (1) had obviously unstable vital signs, (2) had severe arrhythmia, (3) had an obviously abnormal gastrointestinal function, (4) had a life expectancy that was shorter than three months, (5) had a consciousness disorder, (6) showed poor medication compliance, (7) were unable to complete the follow-up, or (8) had incomplete clinical data.

This study was approved by the Ethics Committee of the First People's Hospital of Shenyang in Shenyang, China, and the patients and their families voluntarily participated in the study.

Procedures: Participants' Demographic and Clinical Characteristics

These characteristics included gender, age, smoking status, alcohol consumption, education level, previous history of stroke, family history of stroke, body mass index (BMI), score on the Standardized Swallowing Assessment (SSA), and score on the NIH Stroke Scale (NIHSS).

BMI. To measure BMI, a patient's height and weight wearing underwear were measured in the morning, and BMI = weight/height^2 was calculated.

Triceps skinfold thickness (TSF). To measure the TSF, the practitioner uses the formula AMC = MAC - (TSF × 0.314). MAC is the measurement of the individual's mid-upper-arm circumference, and AMC is the measurement of the individual's upper-arm-muscle circumference. The measured value is compared to a reference value of anthropometric indicators in normal healthy people.

Serum albumin (Alb) and serum prealbumin (PA). Alb effectively reflects the severity of disease and is an important reference index for nutritional status. Compared

with Alb, PA has a shorter half-life, lower serum content, and smaller systemic metabolic pool. It's a more sensitive and effective indicator of nutritional status.

WST. The Watian water-swallow test (WST) is a bedside assessment tool for swallowing function and is widely used in neurology departments. It's currently the most applicable bedside-assessment tool for nursing staff, with good sensitivity and specificity.

A patient is instructed to sit upright and drink 30 mL of warm water to assess his or her swallowing ability: (1) level 1, excellent: the patient can swallow water smoothly once; (2) level 2, good: the patient can swallow water more than 2 times, without bucking; (3) level 3, moderate: the patient can swallow water once, with bucking; (4) level 4, fair: the patient can swallow water more than 2 times, with bucking; and (5) level 5, poor: the patient can't swallow water, with frequent bucking. In the Watian water swallow test, a level of ≥3 indicates the presence of dysphagia.

Standardized Swallowing Assessment (SSA). SSA consists of two steps. The first step is a clinical examination. Items include level of consciousness, head and trunk control, breathing, lip closure, soft palate movement, laryngeal function, gag reflex, and spontaneous cough. In the second step, the patients swallow 5ml of water 3 times, then drink 60 ml of water if there is no abnormality, in order to observe the presence or absence of laryngeal movement, drooling, choking, abnormal vocalization such as wet pronunciation.

Neurological impairment. A participant's neurological impairment was detected using the NIH Stroke Scale (NIHSS) score with mild stroke = 0-5 points, moderate stroke = 5-16 points, and severe stroke = 17-42 points).

Procedures: Nutritional Risk

The research team evaluated participant's nutritional risk using the Nutrition Risk Screening (NRS-2002) and Subjective Global Assessment (SGA) scores. Based on the results of the NRS-2002 and SGA) scales at baseline, participants were enrolled in this study.

NRS-2002. The NRS-2002 score includes the nutritional impairment score, disease severity score, and age score. A total score of ≥3 points indicates the presence of a nutritional risk. The research team divided the NRS-2002 scores into two statuses: a good nutritional status (0-2) or a poor nutritional status (≥3).

SGA. The SGA scores were divided into three statuses: good nutrition (A), malnutrition (B), or severe malnutrition (C). Malnutrition is defined the state when any two of five nutritional indicators are lower than normal levels: (1) BMI < 18.5, (2) TSF < 90% of the normal population standard, (3) AMC<90% of the normal population standard, (4) Alb < 35 g/L, and (5) PA < 200 g/L.

Other Procedures

Models. The research team developed three models of the relationship between nutritional status and prognosis: a crude model, model 1, and model 2. Age, gender, family history of stroke, smoking, alcohol consumption, previous history of stroke, educational level, SSA scale score, NIHSS scale score, BMI, body temperature, and infection were adjusted in the model.

Outcome Measures

The outcomes were the correlations between participants' demographic and clinical characteristics and their nutritional statuses and prognoses.

Nutritional status. NRS2002 is used to detect nutritional risk, while SGA is used to detect malnutrition assessment, which can be further verified. Two types of indicators exist for nutritional status: anthropometric—BMI and TSF—and biochemical indicators—Alb and PA.

BMI. A BMI <18.5 indicates that a patient is underweight; from18.5 to 23.9 indicates that a patient has a normal weight, and ≥24 indicates that a patient is overweight.

TSF. The normal reference value for the TSF is 24.0 cm for men and 21.0 cm for women. To determine nutritional status, >90% of the normal reference value indicates normal nutrition; 80%-90% of the normal reference value indicates mild malnutrition; 60%-80% of the normal reference value indicates moderate malnutrition; and <60% of the normal reference value indicates severe malnutrition.

Alb and PA. Serum albumin can effectively reflect the severity of the disease and is an important reference indicator of nutritional status. Compared with albumin, serum prealbumin (PA) not only has a shorter half-life, but also has less serum content and a smaller systemic metabolic pool, is a more sensitive and effective indicator of nutritional status.

Prognosis. The Modified Rankin Scale (mRS) was used to evaluate participants' prognoses: 0-2 indicated a good prognosis, and ≥3 indicated a poor prognosis. These evaluations occurred at seven days (baseline) and three months after participants' enrollment in the study.

Statistical Analysis

Using SPSS 26.0 (IBM, Armonk, NY, USA), *t* test, chi-square test and F test were performed to analyze and verify the presence of fundamental differences in baseline characteristics between patients with good nutrition and those with poor nutrition. Normally distributed measurement data were expressed as means ± standard deviations (SDs), and comparisons between groups were performed using two independent sample t-tests; non-normally distributed measurement data were expressed as the median and interquartile range [M(QR)], and comparisons between groups were performed using the Wilcoxon rank sum test. Count data were expressed using frequency, and comparisons between groups were performed using the chi-square test. Unconditional logistic regression was used for risk factor analysis. A two-sided $P < .05$ indicated a statistically significant difference.

RESULTS

Participants

Of the 2000 potential participants, 789 patients were diagnosed as having had a stroke with dysphagia and were included in the study. Their ages ranged from 18 to 80 years old.

Table 1. Baseline Characteristics of Participants According to the NRS-2002 Scale

	NRS-2002 Score (7 Days)		
	Good Nutrition	Poor Nutrition	*P* Value
Gender			.018[a]
Female	124 (29.4%)	137 (37.3%)	
Male	298 (70.6%)	230 (62.7%)	
Age, y			<.001[a]
<65	291 (69.0%)	140 (38.1%)	
≥65	131 (31.0%)	227 (61.9%)	
Smoking			.068
No	272 (64.5%)	259 (70.6%)	
Yes	150 (35.5%)	108 (29.4%)	
Alcohol consumption			.017[a]
No	296 (70.1%)	285 (77.7%)	
Yes	126 (29.9%)	82 (22.3%)	
Education			<.001[a]
Primary school	80 (19.3%)	119 (33.0%)	
Junior high school	235 (56.6%)	191 (52.9%)	
Senior high school	72 (17.3%)	37 (10.2%)	
College and university	28 (6.7%)	14 (3.9%)	
Previous history of stroke			.169
No	255 (60.4%)	204 (55.6%)	
Yes	167 (39.6%)	163 (44.4%)	
Family history of stroke			.828
No	396 (93.8%)	343 (93.5%)	
Yes	26 (6.2%)	24 (6.5%)	
Infection			<.001[a]
No	419 (99.3%)	335 (91.3%)	
Yes	3 (0.7%)	32 (8.7%)	
Body temperature, °C			<.001[a]
<37.5	421 (99.8%)	349 (95.1%)	
≥37.5	1 (0.2%)	18 (4.9%)	
BMI			<.001[a]
<25	174 (50.1%)	213 (65.1%)	
≥25	173 (49.9%)	114 (34.9%)	
SSA score			<.001[a]
18	33 (7.8%)	17 (4.6%)	
19-25	299 (71.0%)	188 (51.4%)	
26-31	22 (5.2%)	26 (7.1%)	
32-46	67 (15.9%)	135 (36.9%)	
NIHSS score			<.001[a]
0-8	398 (94.3%)	277 (75.5%)	
9-16	24 (5.7%)	51 (13.9%)	
17-42	0 (0.0%)	39 (10.6%)	

[a]Indicates a statistically significant difference between the good-nutrition group and the poor-nutrition group.

Abbreviations: NRS, Nutrition Risk Screening; BMI, body mass index; SSA, Standardized Swallowing Assessment; NIHSS, National Institutes of Health Stroke Scale.

Table 2. Baseline Characteristics of Participants According to SGA Score

	SGA Score			
	Good Nutrition	Malnutrition	Severe Malnutrition	*P* Value
Gender				.344
Female	140 (31.9%)	108 (33.6%)	13 (44.8%)	
Male	299 (68.1%)	213 (66.4%)	16 (55.2%)	
Age (year)				.093
<65	253 (57.6%)	166 (51.7%)	12 (41.4%)	
≥65	186 (42.4%)	155 (48.3%)	17 (58.6%)	
Smoking				.364
No	292 (66.5%)	216 (67.3%)	23 (79.3%)	
Yes	147 (33.5%)	105 (32.7%)	6 (20.7%)	
Alcohol consumption				.321
No	314 (71.5%)	245 (76.3%)	22 (75.9%)	
Yes	125 (28.5%)	76 (23.7%)	7 (24.1%)	
Education				.358
Primary school	110 (25.4%)	78 (24.8%)	11 (37.9%)	
Junior high school	239 (55.2%)	171 (54.5%)	16 (55.2%)	
Senior high school	64 (14.8%)	43 (13.7%)	2 (6.9%)	
College and university	20 (4.6%)	22 (7.0%)	0 (0.0%)	
Previous history of stroke				.074
No	267 (60.8%)	180 (56.1%)	12 (41.4%)	
Yes	172 (39.2%)	141 (43.9%)	17 (58.6%)	
Family history of stroke				.710
No	409 (93.2%)	302 (94.1%)	28 (96.6%)	
Yes	30 (6.8%)	19 (5.9%)	1 (3.4%)	
Infection				<.001[a]
No	438 (99.8%)	299 (93.1%)	17 (58.6%)	
Yes	1 (0.2%)	22 (6.9%)	12 (41.4%)	
Body temperature, °C				<.001[a]
<37.5	439 (100.0%)	308 (96.0%)	23 (79.3%)	
≥37.5	0 (0.0%)	13 (4.0%)	6 (20.7%)	
BMI				.047[a]
<25	201 (56.0%)	165 (57.1%)	21 (80.8%)	
≥25	158 (44.0%)	124 (42.9%)	5 (19.2%)	
SSA score				<.001[a]
18	43 (9.8%)	7 (2.2%)	0 (0.0%)	
19-25	292 (66.7%)	191 (59.7%)	4 (13.8%)	
26-31	21 (4.8%)	26 (8.1%)	1 (3.4%)	
32-46	82 (18.7%)	96 (30.0%)	24 (82.8%)	
NIHSS score				<.001[a]
0-8	411 (93.6%)	254 (79.1%)	10 (34.5%)	
9-16	28 (6.4%)	41 (12.8%)	6 (20.7%)	
17-42	0 (0.0%)	26 (8.1%)	13 (44.8%)	

[a]Indicates a statistically significant difference between the good-nutrition group and the malnutrition and severe-malnutrition groups.

Abbreviations: SGA, Subjective Global Assessment; BMI, body mass index; SSA, Standardized Swallowing Assessment; NIHSS, National Institutes of Health Stroke Scale.

The differences in baseline characteristics between participants with good nutrition and those with poor nutrition based on the results of the NIHSS scale were statistically significant with regard to gender ($P = .0180$), age ($P < .001$), alcohol consumption ($P = .017$), education level ($P < .001$), presence or absence of infections ($P < .001$), body temperature °C ($P < .001$), and scores on the SSA ($P < .001$) and NIHSS ($P < .001$), as shown in Table 1.

The differences in baseline characteristics between participants with good nutrition and those with malnutrition and severe malnutrition based on the results of the SGA scale were statistically significant with regard to the presence or absence of infection ($P < .001$), body temperature °C ($P < .001$), BMI (0.047), and scores on the SSA ($P < .001$)and NIHSS ($P < .001$), as shown in Table 2.

Table 3. Prognosis of Participants with Different Demographic and Clinical Characteristics

	mRS Score (7 Days)			mRS Score (3 Months)		
	Good Prognosis	Poor Prognosis	*P* Value	Good Prognosis	Poor Prognosis	*P* Value
Gender			.109			.126
Female	163 (31.2%)	98 (36.8%)		185 (31.6%)	76 (37.4%)	
Male	360 (68.8%)	168 (63.2%)		401 (68.4%)	127 (62.6%)	
Age, year			.063			.075
<65	298 (57.0%)	133 (50.0%)		331 (56.5%)	100 (49.3%)	
≥65	225 (43.0%)	133 (50.0%)		255 (43.5%)	103 (50.7%)	
Smoking			.632			.268
No	349 (66.7%)	182 (68.4%)		388 (66.2%)	143 (70.4%)	
Yes	174 (33.3%)	84 (31.6%)		198 (33.8%)	60 (29.6%)	
Alcohol consumption			.481			.308
No	381 (72.8%)	200 (75.2%)		426 (72.7%)	155 (76.4%)	
Yes	142 (27.2%)	66 (24.8%)		160 (27.3%)	48 (23.6%)	
Education			.282			.206
Primary school	122 (23.6%)	77 (29.6%)		137 (23.7%)	62 (31.2%)	
Junior high school	290 (56.2%)	136 (52.3%)		324 (56.2%)	102 (51.3%)	
Senior high school	77 (14.9%)	32 (12.3%)		85 (14.7%)	24 (12.1%)	
College and university	27 (5.2%)	15 (5.8%)		31 (5.4%)	11 (5.5%)	
Previous history of stroke			<.001[a]			.003[a]
No	331 (63.3%)	128 (48.1%)		359 (61.3%)	100 (49.3%)	
Yes	192 (36.7%)	138 (51.9%)		227 (38.7%)	103 (50.7%)	
Family history of stroke			.005[a]			.295
No	499 (95.4%)	240 (90.2%)		552 (94.2%)	187 (92.1%)	
Yes	24 (4.6%)	26 (9.8%)		34 (5.8%)	16 (7.9%)	
Infection			<.001[a]			<.001[a]
No	523 (100.0%)	231 (86.8%)		581 (99.1%)	173 (85.2%)	
Yes	0 (0.0%)	35 (13.2%)		5 (0.9%)	30 (14.8%)	
Body temperature, °C			<.001[a]			<.001[a]
<37.5	523 (100.0%)	247 (92.9%)		584 (99.7%)	186 (91.6%)	
≥37.5	0 (0.0%)	19 (7.1%)		2(0.3%)	17 (8.4%)	
BMI			.936			.089
<25	251 (57.3%)	136 (57.6%)		274 (55.5%)	113 (62.8%)	
≥25	187 (42.7%)	100 (42.4%)		220 (44.5%)	67 (37.2%)	
SSA score			<.001[a]			<.001[a]
18	34 (6.5%)	16 (6.0%)		44 (7.5%)	6 (3.0%)	
19-25	387 (74.3%)	100 (37.6%)		411 (70.4%)	76 (37.4%)	
26-31	27 (5.2%)	21 (7.9%)		34 (5.8%)	14 (6.9%)	
32-46	73 (14.0%)	129 (48.5%)		95 (16.3%)	107 (52.7%)	
NIHSS score			<.001[a]			<.001[a]
0-8	516 (98.7%)	159 (59.8%)		569 (97.1%)	106 (52.2%)	
9-16	7 (1.3%)	68 (25.6%)		17 (2.9%)	58 (28.6%)	
17-42	0 (0.0%)	39 (14.7%)		0 (0.0%)	39 (19.2%)	

[a]Indicates a statistically significant difference between the good-prognosis group and the poor-prognosis group.

Abbreviations: mRS, Modified Rankin Scale; BMI, body mass index; SSA, Standardized Swallowing Assessment; NIHSS, National Institutes of Health Stroke Scale.

Prognosis

At seven days after participants' enrollment in the study, the prognoses were significantly different based on their differences in previous history of stroke ($P < .001$), family history of stroke ($P = .005$), presence or absence of infections ($P < .001$), body temperature ($P < .001$), and scores on the SSA ($P < .001$) and NIHSS ($P < .001$).

At three months after participants' enrollment, the prognoses were significantly different based on their differences in previous history of stroke ($P = .003$), presence or absence of infection ($P < .001$), body temperature ($P < .001$), and scores on the SSA ($P < .001$) and NIHSS ($P < .001$) were significantly different ($P < .001$), as shown in Table 3.

Analysis of Different Models

Nutritional status as classified by the NRS-2002 and SGA was significantly correlated with prognosis, with $P < .001$ for all models, as shown in Table 4.

Correlation Between Prognosis and Nutritional Status

Variables examined in this table weren't adjusted. For the SGA, unconditional logistic regression analysis showed that the prognosis of stroke patients with dysphagia was

Table 4. Relationship of NRS-2002 Score, SGA Score, and Prognosis in Different Models

	Crude Model[a]	Model 1[b]	Model 2[c]
	OR (95% CI)	OR (95% CI)	OR (95% CI)
NRS 2002 score			
Good nutrition	1.0 (Reference)	1.0 (Reference)	1.0 (Reference)
Poor nutrition	4.367 (3.077, 6.199)	4.611 (3.188, 6.669)	2.431 (1.521, 3.885)
P value for trend	<.001[d]	<.001[d]	<.001[d]
SGA score			
Good nutrition	1.0 (Reference)	1.0 (Reference)	1.0 (Reference)
Malnutrition	3.506 (2.462, 4.994)	3.475 (2.439, 4.951)	2.165 (1.380, 3.398)
Severe malnutrition	53.705 (15.771, 182.876)	52.451 (15.389, 178.770)	15.327 (3.736, 62.877)
P value for trend	<.001[e]	<.001[e]	<.001[e]

[a]No adjustments
[b]Adjustment for age (<65, ≥65)
[c]Adjustment for age (<65, ≥65); gender (female, male); family history of stroke (Yes, No); smoking (Yes, No); alcohol consumption (Yes, No); previous history of stroke (Yes, No); education (primary school, junior high school, senior high school, college and university); SSA (18, 19-25, 26-31, 32-46); NIHSS (0-8, 9-16, 17-42); BMI (<25, ≥25); body temperature (<37.5, ≥37.5); infection (Yes, No)
[d]Indicates a statistically significant difference between the good-nutrition group and the poor-nutrition group.
[e]Indicates a statistically significant difference between the good-nutrition group, the malnutrition group, and severe-malnutrition groups.

Abbreviations: SGA, Subjective Global Assessment; NRS, Nutrition Risk Screening; BMI, body mass index; SSA, Standardized Swallowing Assessment; NIHSS, National Institutes of Health Stroke Scale.

Table 5. NRS-2002 and Unconditional Logistic Regression Analysis of Prognosis

	NRS-2002 score, OR (95% CI)		*P* for Interaction
	Good Nutrition	Poor Nutrition	
Age, y			.892
<65 (n=431)	1.0 (Reference)	4.706 (2.934, 7.550)	
≥65 (n=358)	1.0 (Reference)	4.467 (2.482, 8.037)	
Gender			.448
Female (n=261)	1.0 (Reference)	5.260 (2.818, 9.818)	
Male (n=528)	1.0 (Reference)	3.924 (2.562, 6.012)	
Smoking			.381
No (n=531)	1.0 (Reference)	4.843 (3.143, 7.463)	
Yes (n=258)	1.0 (Reference)	3.472 (1.895, 6.363)	
Alcohol consumption			.113
No (n=581)	1.0 (Reference)	5.177 (3.400, 7.884)	
Yes (n=208)	1.0 (Reference)	2.748 (1.419, 5.321)	
Education			.346
Primary school (n=199)	1.0 (Reference)	3.608 (1.797, 7.245)	
Junior high school (n=426)	1.0 (Reference)	3.894 (2.413, 6.282)	
Senior high school (n=109)	1.0 (Reference)	4.773 (1.830, 12.445)	
College and university (n=42)	1.0 (Reference)	11.111 (2.247, 54.940)	
Previous history of stroke			.056
No (n=459)	1.0 (Reference)	6.116 (3.660, 10.220)	
Yes (n=330)	1.0 (Reference)	3.056 (1.870, 4.995)	
Family history of stroke			.739
No (n=739)	1.0 (Reference)	4.444 (3.085, 6.403)	
Yes (n=50)	1.0 (Reference)	3.554 (1.005,12.570)	
Infection			.223
No (n=754)	1.0 (Reference)	3.599 (2.507, 5.166)	
Yes (n=35)	1.0 (Reference)	19.333 (1.327, 281.597)	
NIHSS score			
0-8 (n=675)	1.0 (Reference)	2.937 (1.911, 4.514)	
9-16 (n=75)	1.0 (Reference)	1.688 (0.551, 5.170)	
17-42 (n=39)	1.0 (Reference)		
SSA score			.182
18 (n=50)	1.0 (Reference)	2.143 (0.383, 11.984)	
19-25 (n=487)	1.0 (Reference)	2.905 (1.757, 4.803)	
26-31 (n=48)	1.0 (Reference)	2.812 (0.736, 10.751)	
32-46 (n=202)	1.0 (Reference)	4.730 (2.498, 8.957)	

Abbreviations: NRS, Nutrition Risk Screening; BMI, body mass index; SSA, Standardized Swallowing Assessment; NIHSS, National Institutes of Health Stroke Scale.

Table 6. SGA and Unconditional Logistic Regression Analysis of Prognosis

	SGA Score, OR (95% CI)			P Value for Interaction
	Good Nutrition	Malnutrition	Severe Malnutrition	
Age, y				.455
<65 (n = 431)	1.0 (Reference)	3.279 (2.021, 5.319)	32.206 (6.764, 153.350)	
≥65 (n = 358)	1.0 (Reference)	3.719 (2.210, 6.259)	94.222 (11.996, 740.052)	
Gender				.037[a]
Female (n = 261)	1.0 (Reference)	5.368 (2.846, 10.125)		
Male (n = 528)	1.0 (Reference)	2.837 (1.847, 4.357)	25.114 (6.875, 91.737)	
Smoking				.083
No (n = 531)	1.0 (Reference)	3.970 (2.570,6.133)	142.718 (18.703, 1089.038)	
Yes (n = 258)	1.0 (Reference)	2.721 (1.478, 5.009)	11.364 (1.961,65.841)	
Alcohol consumption				.137
No (n = 581)	1.0 (Reference)	3.894 (2.571, 5.899)	136.000 (17.822, 1037.831)	
Yes (n = 208)	1.0 (Reference)	2.575 (1.295, 5.120)	13.947 (2.520, 77.190)	
Education				.533
Primary school (n = 199)	1.0 (Reference)	3.130 (1.615, 6.069)	45.000 (5.445, 371.898)	
Junior high school (n = 426)	1.0 (Reference)	3.150 (1.929, 5.144)	45.281 (9.828, 208.627)	
Senior high school (n = 109)	1.0 (Reference)	4.362 (1.597, 11.914)		
College and university (n = 42)	1.0 (Reference)	6.231 (1.150, 33.771)		
Previous history of stroke				.201
No (n = 459)	1.0 (Reference)	5.239 (3.158, 8.691)	27.808 (7.081,109.198)	
Yes (n = 330)	1.0 (Reference)	2.218 (1.338, 3.678)		
Family history of stroke				.610
No (n = 739)	1.0 (Reference)	3.409 (2.360, 4.925)	52.530 (15.350, 179.769)	
Yes (n = 50)	1.0 (Reference)	5.556 (1.489, 20.722)		
Infection				.999
No (n = 754)	1.0 (Reference)	3.013 (2.097,4.330)	28.842 (8.052,103.313)	
Yes (n = 35)	1.0 (Reference)			
NIHSS score				.091
0-8 (n = 675)	1.0 (Reference)	2.950 (1.902,4.576)	22.256 (5.532, 89.549)	
9-16 (n = 75)	1.0 (Reference)	0.744 (0.239, 2.318)		
17-42 (n = 39)	1.0 (Reference)			
SSA score				.220
18 (n = 50)	1.0 (Reference)	1.267 (0.125, 12.802)		
19-25 (n = 487)	1.0 (Reference)	3.114 (1.858, 5.219)	29.444 (2.959, 292.964)	
26-31 (n = 48)	1.0 (Reference)	4.400 (1.033, 18.737)		
32-46 (n = 202)	1.0 (Reference)	3.287 (1.770, 6.108)	49.538 (6.343, 386.908)	

[a]Indicates a statistically significant relationship between nutritional status and prognosis and a significant difference by gender.

Abbreviations: SGA, Subjective Global Assessment; BMI, body mass index; SSA, Standardized Swallowing Assessment; NIHSS, National Institutes of Health Stroke Scale.

related to nutritional status, and statistically significant differences existed related to gender ($P < .05$). A significant relationship existed for gender, indicating that the correlation between prognosis and nutritional status in male patients is stronger than that in female patients. Male participants were susceptible to malnutrition, causing a poor prognosis, as shown in Table 6. Variables examined in this table weren't adjusted.

DISCUSSION

The current study confirmed the results of previous studies[14,15] about the relationship between nutritional status and prognostic effects. Understanding the implementation of nutritional therapy for stroke patients with dysphagia can establish the basis for the formulation of further clinical interventions against the nutritional problems in stroke patients with dysphagia.

Due to the limited time and the cooperation of patients during follow-up, the application of the scales has certain limitations. More scales will be used for comparison and analysis in our future investigations.

CONCLUSIONS

The prognosis of stroke patients with dysphagia is related to nutritional status. A better nutritional status indicates the better prognosis, and vice versa. Therefore, the nutritional status of patients should be improved in clinical treatment.

AUTHORS' DISCLOSURE STATEMENT

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