

# Dysphagia and Nutritional Status at the Time of Hospital Admission for Ischemic Stroke

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*Background:* Dysphagia and poor nutritional status occur frequently after stroke; however, potential associations between them are unknown. We evaluated potential associations between dysphagia and poor nutritional status in patients with acute ischemic stroke. Potential associations between these outcomes and more global stroke severity measures were also assessed. *Methods:* In all, 76 patients with acute ischemic stroke were recruited on admission to the dedicated stroke department of an academic medical center. All patients were assessed with a clinical swallowing evaluation, Functional Oral Intake Scale, Mini Nutritional Assessment, body mass index, percent body fat, National Institutes of Health Stroke Scale, modified Rankin Scale, and modified Barthel Index. Associations were evaluated among dysphagia, nutrition, and stroke severity measures. *Results:* On clinical examination 52.6% of study patients demonstrated dysphagia and 26.3% were identified with poor nutritional status. Dysphagia, based on clinical assessment, was associated with stroke severity (National Institutes of Health Stroke Scale, odds ratio [OR] 4.6, 95% confidence interval [CI] 1.6-13.1; modified Rankin Scale, OR 12.3, 95% CI 3.2-47.4) and with functional oral intake (OR 29.2, 95% CI 8.4-101.8), but not with measures of nutritional status (Mini Nutritional Assessment, OR 1.0, 95% CI 0.4-2.8). Nutritional measures did not correlate with swallowing or stroke severity measures. *Conclusions:* Dysphagia and poor nutritional status are prevalent in patients with acute ischemic stroke, however, they are not associated with each other at the time of hospital admission. Furthermore, dysphagia, but not nutritional status, is associated with stroke severity measures. **Key Words:** Ischemic stroke—dysphagia—nutritional status.

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Studies using a variety of definitions of both dysphagia and poor nutritional status, and disparate methods to measure these conditions, consistently reveal that

both dysphagia and poor nutritional status occur frequently in patients with acute stroke.<sup>1-6</sup> Although dysphagia and poor nutritional status often coexist, the nature of their association remains vague. Both are related to increased mortality and reduced functional outcomes in patients with stroke.<sup>7-11</sup> Both may impact the type of postacute rehabilitation and interventions afforded to patients with stroke and influence health care resource use.<sup>12</sup>

The primary purpose of this study was to estimate the prevalence of dysphagia and poor nutritional status in patients hospitalized with acute ischemic stroke and to identify potential associations between these outcome measures and more global stroke severity indices. Prior studies have varied greatly in the tools used to identify both dysphagia and nutritional status. The current study

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used clinical tools that were developed and standardized in elderly populations including acute stroke to offer a consistent framework for comparison. As an initial investigation, this study used a cross-sectional design in an attempt to identify associations between dysphagia and poor nutritional status and factors that may impact any obtained association in a population of patients with acute ischemic stroke.

## Materials and Methods

### *Patients*

In all, 76 patients were recruited into the study during a 7-month period (May-December 2004). All study participants were inpatients of the stroke department at a 750-bed tertiary care hospital that serves as a major teaching hospital for the University of Florida. A neurologist with fellowship training in stroke and cerebrovascular diseases confirmed a diagnosis of ischemic stroke. All patients underwent brain imaging (computed tomography scan, magnetic resonance imaging, or both) examinations. Patients who had a prestroke history of oropharyngeal dysphagia, head/neck surgery or trauma that may impact swallowing ability, or concomitant neurologic disorder that would impact oropharyngeal swallowing ability were excluded from this study. The local institutional review board approved this study. All enrolled patients or their approved proxy signed an informed consent.

### *Data Collection*

All patients enrolled in this study received stroke-, dysphagia-, and nutrition-specific evaluations. Stroke-specific evaluations were completed by qualified stroke neurologists (S. S. or N. A.). Dysphagia- and nutrition-specific evaluations were completed by a licensed speech pathologist (L. M.) trained in the assessment procedures used in this study. The average interval between hospital admission and completion of neuroradiologic examinations was 0.22 and 1.2 days for computed tomography and magnetic resonance imaging, respectively. On average, patients were recruited into the study and completed clinical outcome measure evaluations within 2 days (mean 2.2 days) of being admitted to the stroke department. Two thirds (67%) of all clinical evaluations were completed within 2 days of admission to the stroke department and all evaluations were completed within 4 days. Collectively, patients were evaluated with the clinical outcome measures on an average of 2.82 days after prehospital recognition of stroke symptoms.

Stroke subtype was classified by the Oxfordshire Community Stroke Project classification criteria.<sup>13</sup> Stroke severity was assessed using the National Institutes of Health Stroke Scale (NIHSS).<sup>14,15</sup> Obtained scores were

used except when this measure was dichotomized. A cut-off score of 8 was used for dichotomized analyses. Although no cut point on this scale is universally accepted, this value was chosen because a score of more than 8 was used in the National Institute of Neurological Disorders and Stroke recombinant tissue plasminogen activator study to define a severe poststroke neurologic deficit.<sup>16</sup> Functional outcome was measured using the modified Rankin Scale (mRS)<sup>17</sup> and the modified Barthel Index (mBI).<sup>18</sup> Dichotomized cut-off scores were 3 or greater for the mRS and less than 12 for the mBI.

Clinical evaluation of dysphagia was completed with the Mann Assessment of Swallowing Ability (MASA).<sup>19</sup> This tool evaluates cognitive, communicative, and motor aspects of a stroke patient's abilities that may impact swallowing ability. On this clinical tool, a score of less than 178 identifies patients with clinical symptoms and signs of dysphagia. The scoring system and ability to detect dysphagia for this clinical tool have been validated against instrumental assessment of dysphagia by videofluoroscopy.<sup>19</sup> Ability to consume food, liquid, or both by mouth was documented with the Functional Oral Intake Scale (FOIS).<sup>20</sup> This is a 7-point ordinal scale that describes the typical functional oral intake of patients with stroke and dysphagia. When this scale was dichotomized, a score below 6 of a maximum of 7 was used to indicate limitations in oral intake of food and liquid.

Nutrition-specific evaluations included measures of body mass index (BMI) and percent body fat in combination with completion of the Mini Nutritional Assessment (MNA). When dichotomized, a BMI less than or equal to 18.0 represented patients in the poor nutrition category. A BMI of more than 30 represented patients in the obese category. Percent body fat was calculated from 3-site skinfold measurement. Lange skinfold calipers were used to make these measurements. From male patients, skinfold measurements were obtained from lateral chest, abdomen, and thigh. For female patients, skinfold measurements were obtained from triceps, suprailliac region, and thigh. Body fat percentages were used as a general assessment of nutritional status reflected in body composition. These values were not dichotomized. Finally, the MNA was used as a standard, validated clinical evaluation of nutritional status.<sup>21</sup> On this assessment tool, a score of less than 23.5 indicates poor nutritional status.

Other patient demographic and medical variables were completed from chart review. These variables are listed and defined in [Table 1](#).

### *Statistical Analyses*

Patient demographic variables were described by mean and variance statistics for continuous variables or prevalence statistics for categorical variables. Correlation analyses were used to examine potential relationships among continuous variables. Subgroups were identified based on dys-

**Table 1.** Patient demographic and medical variables from chart review

Variable	Abbreviation	Description
Age	NA	Age, y
Sex	NA	Male or female
Race	NA	Caucasian, African American, other
Marital status	NA	Living alone or with a spouse at the time of stroke
Prior stroke	NA	Patient did or did not have a history of a stroke before the current event
Diabetes mellitus	NA	One of the following: <ul style="list-style-type: none"> <li>• Fasting plasma glucose <math>\geq 126</math> mg/dL</li> <li>• 2-hour oral glucose tolerance test <math>&gt; 200</math> mg/dL</li> <li>• On medication for diabetes mellitus or documented prior treatment for diabetes mellitus</li> </ul>
Chronic hypertension	Hypertension	One of the following: <ul style="list-style-type: none"> <li>• Systolic blood pressure <math>\geq 140</math> mm Hg or diastolic blood pressure <math>&gt; 90</math> mm Hg based on the mean of at least two readings conducted on two different days</li> <li>• History of treatment for chronic hypertension</li> </ul>
Smoking	NA	Patient is smoking or using smokeless tobacco at the time of stroke or recently (within a few months) quit smoking or using smokeless tobacco
Alcohol	NA	Patient is identified as using excessive alcohol as documented in medical chart
Coronary artery disease	CAD	One of the following: <ul style="list-style-type: none"> <li>• History of angina</li> <li>• History of myocardial infarction</li> <li>• History of coronary artery intervention such as CABG or angioplasty</li> </ul>
Atrial fibrillation	AFIB	Atrial fibrillation identified on electrocardiogram or documented in medical records
Hyperlipidemia	NA	One of the following: <ul style="list-style-type: none"> <li>• Total cholesterol 200-239 mg/dL</li> <li>• LDL cholesterol 130-159 mg/dL</li> <li>• Taking a medication for hyperlipidemia</li> </ul>
Intervention with thrombolysis	rTPA	Whether or not patients were treated with rTPA

NA, Not applicable; CAD, coronary artery disease; CABG, coronary artery bypass graft; AFIB, atrial fibrillation; LDL, low-density lipoprotein; rTPA, recombinant tissue plasminogen activator.

phagia and nutrition cut-off scores on clinical protocols (MASA and MNA). Demographic variables were then examined between subgroups using odds ratio (OR) with 95% confidence interval (CI) to identify any variable significantly associated with dysphagia or poor nutritional status as defined in this study. All statistical analyses were completed using software (SPSS, Version 12.0, Chicago, IL).

## Results

Descriptive data for continuous variables are presented in Table 2. Descriptive data for categorical variables are presented in Table 3. Scores from the NIHSS, mBI (Table 2), and mRS (Table 3) identified this patient group as moderately impaired. The majority of strokes (Table 3) were partial anterior circulation infarcts with lower numbers of patients demonstrating total anterior circulation infarcts.

Sex was approximately equally distributed within this sample, as was race and marital status, although slightly more Caucasian patients and slightly more patients who were not married at the time of stroke were recruited into the study (Table 3). Diabetes mellitus was identified in 33% of patients, but chronic hypertension was more prevalent at 76%. The majority of patients did not report extensive tobacco or alcohol use. Few patients had histories or clinical findings of coronary artery disease or atrial fibrillation, but 37% had identified hyperlipidemia. Intravenous thrombolytic therapy with tissue plasminogen activator was administered to 9% of this sample (Table 3).

Table 4 presents dichotomized data from dysphagia, nutrition, and stroke severity variables. Just more than half (52.6%) of the sample was identified as demonstrating dysphagia based on the MASA examination with 50% demonstrating some limitation in oral intake of food and liquid as reflected in the FOIS. Based on the MNA, just

**Table 2.** Descriptive data for continuous variables obtained from 76 patients with acute ischemic stroke

Variable	Mean	SD	95% CI	Minimum	Maximum
Age, y	66.2	11.8	63.4-69.1	36	87
NIHSS	7.3	5.9	5.9-8.8	0	22
mBI	9.6	6.7	8.0-11.2	0	20
MASA	169.4	27.8	162.8-176.1	91	200
MNA	24.9	3.8	24.0-25.8	15	30
Fat, %	30.0	6.0	28.6-31.5	10	40
BMI	27.7	5.3	26.4-29.0	17	44

NIHSS, National Institutes of Health Stroke Scale; mBI, modified Barthel Index; MASA, Mann Assessment of Swallowing Ability; MNA, Mini Nutritional Assessment; %Fat, percent body fat; BMI, body mass index; CI, confidence interval.

more than a quarter of the patients (26.3%) were classified as having poor nutritional status at the time of admission. However, BMI scores identified a much smaller percentage of malnourished patients (1.3%). BMI scores indicated that 31.6% of this sample was obese. Stroke impairment as measured by the NIHSS, mRS, and mBI suggest that approximately half of this sample demonstrated at least moderate impairment.

Table 5 presents results of correlation analyses among continuous variables for stroke severity, dysphagia, and nutritional status. Both dysphagia measures (MASA, FOIS) correlated significantly with stroke severity measures (NIHSS,  $-0.576$ ,  $-0.516$ ; mRS,  $-0.656$ ,  $-0.561$ ; mBI,  $0.559$ ,  $0.498$ ), but not with any measure of nutritional status (MNA,  $0.029$ ,  $-0.055$ ; percent body fat,  $0.146$ ,  $0.123$ ; BMI,  $0.223$ ,  $0.185$ ). Likewise, none of the nutritional measures (MNA, percent body fat, BMI) correlated significantly with any of the stroke severity measures. The stroke severity measures correlate with each other as do the dysphagia measures. Results from the MNA correlate with BMI results but not with percent body fat. BMI does correlate with percent body fat.

Table 6 presents results of association analyses among categorical (dichotomized) variables for dysphagia and poor nutritional status. Only 4 variables are significantly associated with the presence of dysphagia. Scores on the mRS (OR 12.3, 95% CI 3.2-47.4), NIHSS (OR 4.6, 95% CI 1.6-13.1), mBI (OR 5.6, 95% CI 2.0-15.5), and FOIS (OR 29.2, 95% CI 8.4-101.8) are significantly associated with dysphagia. Other variables (sex, hypertension, smoking, alcohol use, atrial fibrillation, and total anterior circulation infarcts) revealed elevated ORs suggesting trends of association with dysphagia; however, these were not statistically significant. Treatment with recombinant tissue plasminogen activator or low BMI were not analyzed with these procedures owing to empty cells in the  $2 \times 2$  matrix.

Only a single variable, smoking, was significantly associated with poor nutritional status as defined in this study (OR 4.1, 95% CI 1.3-13.5). Additional variables (mBI, coronary artery disease, hyperlipidemia, and total/

partial anterior circulation infarcts) revealed elevated ORs suggesting trends of association with poor nutritional status; however, these were not statistically significant. Low BMI or posterior circulation syndrome (POCS) were not analyzed with these procedures owing to empty cells in the  $2 \times 2$  matrix.

## Discussion

This study found no significant associations between dysphagia and nutritional status in a sample of patients with acute ischemic stroke at the time of initial hospitalization for their stroke. Furthermore, although dysphagia was related to stroke severity, nutritional status was not. The primary nutritional outcome measure in this study, the MNA, may be a better indicator of premorbid nutritional status than nutritional changes after stroke. Items on the MNA include dietary changes, weight loss, and stress factors that may have occurred 3 months before the evaluation. In addition, the MNA includes anthropomorphic measures such as BMI, midarm circumference, and calf circumference. These measures would not be expected to reflect rapid changes in nutritional status as they rely on physical changes in weight or body fat that are reactive to a prolonged state of poor nutrition. In fact, in the current study, these measures underestimated nutritional deficits relative to the MNA, likely as a result of the singular focus inherent in BMI and percent body fat measures. Other items in the MNA, specifically pressure sores or skin ulcers, also reflect more chronic nutritional problems. Therefore, although the MNA has demonstrated a strong relationship with both energy intake ( $r = 0.50$ ,  $P < .001$ ) and serum albumin ( $r = 0.71$ ,  $P < .001$ ), it may not be sensitive to potentially rapid changes in nutritional status. In this regard, the MNA is similar to the Subjective Global Assessment that has been used recently to study the impact of premorbid nutritional status on stroke outcome.<sup>5</sup> Our results would suggest that premorbid nutritional status, as defined by MNA results, does not impact either stroke severity at stroke

**Table 3.** Descriptive data for ordinal and categorical variables obtained from 76 patients with acute ischemic stroke

Variable	Level	Percent*	No. of patients
Sex	Male	47	36
	Female	53	40
Race	African American	47	36
	Caucasian	51	39
Marital status	Married	38	29
	Not married	62	47
Prior stroke	Yes	34	26
	No	63	48
Diabetes	Yes	33	25
	No	66	50
Hypertension	Yes	76	58
	No	22	17
Smoking	Nonsmoker	79	60
	Smoker or recent history	20	15
Alcohol	Drinker	9	7
	Nondrinker	88	67
CAD	Yes	15	11
	No	84	64
AFIB	Yes	11	8
	No	88	67
Hyperlipidemia	Yes	37	28
	No	62	47
Stroke type (OCSF)	TACS	11	8
	PACS	50	38
	LACS	22	17
	POCS	11	8
rTPA	Yes	9	7
	No	91	69
Modified Rankin scale	0	4	3
	1	5	4
	2	18	14
	3	24	18
	4	32	24
	5	16	12
	6	12	9
FOIS	1	3	2
	2	0	0
	3	4	3
	4	16	12
	5	28	21
	6	12	9
	7	38	29

CAD, Coronary artery disease; AFIB, atrial fibrillation; FOIS, Functional Oral Intake Scale; OCSF, Oxfordshire Community Stroke Project; TACS, total anterior circulation syndrome; PACS, partial anterior circulation syndrome; LACS, lacunar syndrome; POCS, posterior circulation syndrome; rTPA, recombinant tissue plasminogen activator.

\*Values not equaling 100% are a result of missing data.

onset or the presence or severity of acute poststroke dysphagia.

The lack of association between nutritional status and dysphagia is in agreement with earlier findings in acute stroke reported by Davalos et al,<sup>4</sup> who identified no nutritional differences between patients with and without swallowing problems at admission. These investigators used a combination of blood serum markers (serum albumin) and anthropomorphic markers (triceps skinfold and midarm muscle circumference) to estimate nutritional status. Likewise, preliminary results from the FOOD Trial<sup>7</sup> reported no descriptive differences in the percent of patients with swallowing impairment among undernourished, normal weight, and overweight patients with stroke. These investigators used various combinations of clinical impression, anthropomorphic measures, and blood serum markers to assess nutritional status within an average time interval of 7 days after stroke symptom onset. No other studies have examined potential relationships between swallowing ability and nutritional status in the patient with acute stroke. Thus, the results of the current study in combination with prior investigations suggest that nutritional status is not related to the presence of dysphagia in the patient with acute stroke at the time of hospital admission.

In this study, dysphagia was significantly associated to multiple measures of stroke severity. At least one prior study has suggested that stroke severity was an important predictor of dysphagia. Mann and Hankey<sup>22</sup> reported that disabling stroke as measured by the Barthel Index (score < 60 on the full index) was a significant predictor of dysphagia (assessed by radiographic procedure) in a group of 128 patients with acute stroke. In the

**Table 4.** Frequency of impairment of dysphagia, nutrition, and stroke severity variables among 76 patients with acute ischemic stroke

Measure	No. of patients impaired	Percent impaired
Dysphagia (MASA < 178)	40	52.6
Dysphagia (FOIS < 6)	38	50
Nutrition (MNA < 23.5)	20	26.3
Nutrition (BMI low < 18)	1	1.3
Nutrition (BMI high = obese > 30)	24	31.6
Stroke (mRS > 3)	54	71.1
Stroke (NIHSS > 8)	27	35.5
Stroke (mBI < 12)	40	60.5

MASA, Mann Assessment of Swallowing Ability; FOIS, Functional Oral Intake Scale; MNA, Mini Nutritional Assessment; BMI, body mass index; mRS, modified Rankin Scale; NIHSS, National Institutes of Health Stroke Scale; mBI, modified Barthel Index.

Individual measures and cut-off scores are identified within parentheses.

**Table 5.** Correlations among outcome measures for dysphagia, nutritional status, and stroke severity in 76 patients with acute ischemic stroke

	MASA	FOIS	MNA	%Fat	BMI	Age	NIHSS	mRS	mBI
MASA		.837*	-.029	.146	.223†	-.038	-.576*	-.656*	.559*
FOIS			-.055	.123	.185	-.079	-.516*	-.561*	.498*
MNA				.205	.287*	.063	-.116	-.131	.001
%Fat					.478*	-.030	.100	-.104	-.175
BMI						-.262*	-.060	-.083	.056
Age							-.125	.112	-.246*
NIHSS								.727*	-.614*
mRS									-.671*

MASA, Mann Assessment of Swallowing Ability; FOIS, Functional Oral Intake Scale; MNA, Mini Nutritional Assessment; %Fat, percent body fat; BMI, body mass index; NIHSS, National Institutes of Health Stroke Scale; mRS, modified Rankin Scale; mBI, modified Barthel Index.

\*Significant beyond the .05 level.

†P = .056.

**Table 6.** Odds ratio and 95% confidence interval results for categorical variable comparisons with dysphagia (+/-) and poor nutritional status (+/-)

Comparison	Dysphagia		Nutritional status	
	OR	95% CI	OR	95% CI
mRs	12.3	3.2-47.4	1.3	0.4-4.3
NIHSS	4.6	1.6-13.1	1.7	0.6-5.0
mBI	5.6	2.0-15.5	2.6	0.8-8.0
rTPA	—*	—	2.1	0.4-10.2
Prior stroke	0.5	0.2-1.2	0.7	0.2-2.0
Sex	1.9	0.8-4.8	0.6	0.2-1.7
Marital status	1.2	0.5-3.0	1.1	0.4-3.0
Race	1.0	0.4-2.4	0.8	0.3-2.2
Diabetes	0.6	0.2-1.5	0.8	0.3-2.4
Hypertension	1.3	0.5-3.9	0.5	0.2-1.4
Smoking	2.1	0.6-6.7	4.1	1.3-13.5
Alcohol	6.2	0.7-54.0	1.0	0.2-5.8
CAD	0.4	0.1-1.4	1.6	0.4-6.1
Afib	1.6	0.3-7.1	1.0	0.2-5.9
Hyperlipidemia	0.7	0.3-1.7	1.5	0.5-4.2
Poor nutrition	1.0	0.4-2.8	—	—
Dysphagia	—	—	1.0	0.4-2.8
FOIS	29.2	8.4-101.8	0.9	0.3-2.5
Obesity	0.4	0.1-1.1	0.4	0.1-1.3
Bamford type (OCSP)				
TACS	3.7	0.8-19.2	2.3	0.5-9.4
PACS	0.8	0.3-1.9	1.6	0.6-4.4
LACS	1.1	0.4-3.1	0.7	0.2-2.5
POCS	0.5	0.1-2.3	—†	—

mRs, Modified Rankin scale; NIHSS, National Institutes of Health Stroke Scale; mBI, modified Barthel Index; rTPA, recombinant tissue plasminogen activator; CAD, coronary artery disease; Afib, atrial fibrillation; FOIS, Functional Oral Intake Scale; OCSP, Oxfordshire Community Stroke Project; TACS, total anterior circulation syndrome; PACS, partial anterior circulation syndrome; LACS, lacunar syndrome; POCS, posterior circulation syndrome.

Continuous and ordinal variables were dichotomized using accepted or clinically plausible cut points for this analysis.

\*Could not compute OR for rTPA or BMI undernutrition (<18) secondary to empty cells in the 2 × 2 matrix.

†Could not compute OR for BMI undernutrition (<18) or POCS secondary to empty cells in the 2 × 2 matrix.

current study, all indices of stroke severity (NIHSS, mRS, and mBI) were significantly associated with the presence of dysphagia. The mRS demonstrated the strongest association (OR 12.3, 95% CI 3.2-47.4). Although the current study design does not allow for specific interpretation of this observed association, recent literature implicates possible contributing mechanisms. Heckmann et al<sup>23</sup> have identified an association among dysphagia (assessed clinically), stroke severity (NIHSS), and hypogeusia in patients with acute stroke. These investigators speculated that taste deviations might contribute to reduced intake of food, liquid, or both; an observation consistent with FOIS results in the current study. Certainly, potential associations among swallowing ability, stroke severity, chemosensory status, food/liquid intake, and nutritional status merit further study.

Nutritional status did not correlate or associate with any of the stroke severity measures. Conversely, Davalos et al<sup>4</sup> reported that malnourished status was significantly associated with stroke severity (Canadian Stroke Scale  $\leq 5$ ) at admission. The criteria for malnourishment in their study was either low serum albumin or triceps skinfold or midarm circumference less than the 10th percentile of their reference population. These investigators did not account for potential premorbid functional limitations that might impact their measures. Perhaps reduced premorbid nutritional status contributed to the severity of stroke-related impairment in their sample. However, Davis et al<sup>5</sup> found that stroke severity as measured by the NIHSS was not associated with premorbid nutritional status as measured by the Subjective Global Assessment in patients with acute stroke. These investigators did use a premorbid mRS ( $\geq 3$ ) to identify a significant association with premorbid nutritional status measured by the Subjective Global Assessment. One suggestion is that premorbid functional level may impact nutritional status preceding stroke. This observation may be supported by the finding in the current study that smoking was the only premorbid variable significantly associated (OR 4.1, 95% CI 1.3-13.5) with poor nutritional status as measured by the MNA. In prior research, smoking has been associated with poor nutritional status and with increased risk of ischemic stroke.<sup>24,25</sup>

A strength of this study was the inclusion of standard clinical assessment protocols for both dysphagia and nutritional assessment. MASA was specifically developed and validated to assess dysphagia in patients poststroke.<sup>19</sup> This clinical assessment has been validated against videofluoroscopic findings in patients with stroke and demonstrates good sensitivity and specificity in the identification of both dysphagia (Sensitivity [SE]-73, Specificity [SP]-89) and aspiration (SE 93, SP 63). Evaluation of the recommended cut point for dysphagia (<178) revealed that this clinical assessment is able to discriminate between patients with and without swallowing difficulties (SE 71, SP 72). The positive predictive value of a

MASA score less than 178 for predicting any videofluoroscopic evidence of dysphagia was 81.7%, demonstrating acceptable predictive ability in comparison with videofluoroscopy. The MASA is a commonly used tool that is widely accepted and accessible for replication efforts.

Similar to the MASA, the MNA was developed and validated to assess nutritional status in elderly patients. However, this tool has not been specifically validated for use in patients poststroke. Thus, although validated and accessible methods were used for both dysphagia and nutritional assessments, this study was the first attempt to use the MNA to evaluate nutritional status in a sample of patients poststroke. One result of that application is the implication that this tool may be biased toward premorbid factors (e.g., mobility, weight loss, dietary habits) that impact nutritional status in the patient with stroke at the time of hospitalization. This implication is one potential limitation of the current study. A similar argument may be applied to both BMI and percent body fat. These methods may be relatively insensitive to very rapid changes in nutritional status.

Davalos et al<sup>4</sup> reported that nutritional indices deteriorated during the first week poststroke. This finding is consistent with many observations of nutritional decline after stroke.<sup>3,4,8</sup> In addition, poor nutritional status, like dysphagia, is often associated with poorer stroke outcome and with measures of severity and other comorbidities subsequent to the immediate poststroke period.<sup>4-6</sup> It is conceivable that in the immediate poststroke period, nutritional status is more representative of premorbid status and that with time, nutritional decline results from stroke-related factors, including dysphagia. From this perspective, combining assessments that identify rapid nutritional changes with techniques that reflect more long-term nutritional status and investigating additional variables that have the potential to impact nutritional status would prove beneficial.

### Conclusion

This study found no significant relationship between dysphagia and nutritional status in patients with ischemic stroke at hospital admission. Furthermore, although dysphagia was significantly related to stroke severity, nutritional status was not. The potential influence of prestroke parameters such as acute and chronic medical conditions, social history, and dietary history must be considered when evaluating nutritional status at admission. Early identification of dysphagia and nutritional deficits is important as both are prevalent in patients with acute ischemic stroke and both are related to unfavorable outcomes. In addition, it will be imperative to pursue longitudinal studies of dysphagia and nutritional status in stroke survivors to more fully understand the potential interaction of these two dynamic morbidities, factors that

influence their presence and severity, and their combined impact on longer-term stroke outcome. Finally, interventions that improve swallowing ability may enhance the nutritional status of patients with ischemic stroke. These interventions could potentially reduce morbidity and mortality associated with ischemic stroke.<sup>26</sup>

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