

## Original articles

# Evolution of swallowing in post-acute stroke: a descriptive study

## *Evolução da deglutição no pós-AVC agudo: estudo descritivo*

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## ABSTRACT

**Purpose:** to analyze the evolution of post-stroke swallowing impairment.

**Methods:** this is a descriptive exploratory study involving a non-probabilistic sample that evaluated 100 stroke patients admitted at the Hospital Público Regional de Betim. Patients were subjected to a speech pathologist structured evaluation two times: in the first 48 hours after stroke and at hospital discharge. The Gugging Swallowing Screen, a standardized and validated bed-side tool for evaluating swallowing in stroke patients, was used.

**Results:** in the initial evaluation, the frequency of dysphagia was 52%, and 28% of patients were classified as severe dysphagia with a high risk of aspiration. The mean time between the initial evaluation and hospital discharge was 22.1 days. At the hospital discharge, only 2.1% of patients still had severe dysphagia. It was observed change in the patient swallowing profile according to the severity of dysphagia.

**Conclusion:** the frequency of post-stroke dysphagia is high, but there are progressive changes in the swallowing profile of stroke patients during their hospital stay.

**Keywords:** Stroke; Deglutition Disorders; Clinical Evolution

## RESUMO

**Objetivo:** analisar a evolução da deglutição de pacientes após acidente vascular cerebral.

**Métodos:** trata-se de estudo exploratório descritivo com amostra não probabilística em que foram acompanhados 100 pacientes admitidos com o diagnóstico de acidente vascular cerebral no Hospital Público Regional de Betim. Os pacientes foram submetidos à avaliação fonoaudiológica estruturada em dois momentos: nas primeiras 48 horas após acidente vascular cerebral e no momento da alta hospitalar. Utilizou-se a escala *Gugging Swallowing Screen* que é um instrumento padronizado e validado para ser utilizado na beira do leito.

**Resultados:** na avaliação fonoaudiológica inicial, a frequência da disfagia foi de 52%, sendo que 28% dos pacientes foram classificados como disfagia grave com alto risco de aspiração. A média de tempo entre a avaliação inicial da deglutição e a do momento da alta hospitalar foi de 22,1 dias. Na alta, apenas 2,1% dos pacientes ainda apresentavam disfagia grave. Observou-se mudança do perfil de deglutição do paciente de acordo com a gravidade da disfagia e da consistência da dieta oral.

**Conclusão:** a frequência de disfagia após acidente vascular cerebral é alta, mas há progressiva mudança no perfil de deglutição do paciente durante o período de internação.

**Descritores:** Acidente Vascular Cerebral; Transtornos de Deglutição; Evolução Clínica

## INTRODUCTION

Dysphagia is clinically diagnosed in 40 to 70% of patients in the first three days after stroke, and the incidence of aspiration of saliva, food and/or liquid ranges from 20 to 45% in the first five days<sup>1-3</sup>. Dysphagia is associated with impaired food intake, which can lead to malnutrition during hospital stay and to pulmonary complications, especially pneumonia by aspiration<sup>3-7</sup>. In addition, it also has potential impact on emotional aspects of food, as it can lead to withdrawal and isolation of the patients, compromising their quality of life<sup>6</sup>.

The initial speech evaluation and prophylactic and therapeutic interventions in acute stroke patients are able to reduce the rates of dysphagia-related complications<sup>1,7-10</sup>.

The swallowing function can be evaluated both instrumentally and/or clinically. Videofluoroscopy is a method that enables the objective analysis of the swallowing biomechanics, being considered the gold standard examination in the study of dysphagia. However, it is an expensive procedure not available in most Brazilian hospital services<sup>11-16</sup>. Thus, in order to define specific procedures during the acute phase of stroke, tools to investigate swallowing have been developed and validated to identify dysphagia and measure its intensity<sup>17-22</sup>.

Few studies have systematically evaluated the evolution of swallowing deficits during the period after stroke and they showed a great variability of results<sup>23-31</sup>. This is possibly due to methodological issues, such as different sample sizes, location, extent and type of stroke, pairing of patients in gender, age and comorbidities, and use of different and/or not valid protocols.

The purpose of this study is to analyze the evolution of swallowing after stroke.

## METHODS

This is a descriptive exploratory study with a non-probabilistic sample. From May to November 2008, all patients of the Regional Public Hospital of Betim (HPRB), Minas Gerais, with stroke diagnosis confirmed by neurologists, were invited to participate of this study. It included one hundred patients.

The inclusion criteria were: acute stroke patients, with or without dysphagia and language disorder. The exclusion criteria were: patients in a coma and/or assisted ventilation.

The study was approved in advance by the Board of the HPRB and approved by the Research Ethics Committee of Universidade Federal de Minas Gerais according to the procedure number ETIC 207/08. The individuals of the research or their guardians were duly informed and have authorized the research according to the Free and Cleared Term of Consent.

Clinical and sociodemographic data were collected from medical records and through interviews and/or evaluations. The clinical evaluation of swallowing was carried out by a speech therapist who led the study in two different times. The first evaluation took place at the bedside in the first 48 hours after the stroke. At the time of hospital discharge, a second evaluation of swallowing was performed in order to observe the evolution of the clinical parameters during the hospital stay.

The *Gugging Swallowing Screen* - GUSS<sup>27</sup> (attached) was used. It is a standardized and valid tool for stroke patients to be used at the bedside. It is an international scale not validated for Brazilian Portuguese. To date, there is no dysphagia screening protocol in the national literature valid for patients after stroke.

The scale presents two steps, the first called "indirect swallowing test or saliva swallow" and the second "direct swallowing test".

In the indirect swallowing test, the dysphagia criteria are: alertness, voluntary cough and/or throat clearing, saliva swallow, drooling and vocal change.

The direct swallowing test is divided into three sub-steps according to the texture of the food to be evaluated, being semisolid (pudding), liquid and solid in this order. The offered volumes followed the standards suggested in the original article<sup>27</sup>. For each texture, the criteria for dysphagia are: swallowing and oral transit time, involuntary cough before, during or after three minutes of the pharyngeal swallowing phase, drooling and voice change.

The dysphagia criteria are scored with variation from 0 to 2 points for each item.

The evaluation steps are sequential, and in each step, the score for the proper swallowing pattern is equal to five points. Thus, it is necessary that the patient swallow the saliva successfully (value equal to 5 points) to proceed with the direct swallowing test in the first texture (semisolid). For assessment of the liquid texture, a 5 point score in the semisolid texture is necessary. And for assessment of the solid texture, an appropriate swallowing pattern in the liquid texture is required (value equal to 5 points). The total value of the

GUSS scale is 20 points, i.e., patients with adequate swallowing pattern of: saliva, semisolid, liquid and solid texture.

After application of the protocol, and through the obtained score, it is possible to classify the swallowing process in normal/without dysphagia (20), slight dysphagia with low risk of aspiration (15 to 19), moderate dysphagia with risk of aspiration (10 to 14) and severe dysphagia with a high risk of aspiration (0 to 9).

In case of dysphagia (score below 20), the routine rehabilitation of swallowing was performed by speech therapists who led the study, aiming at the release of oral feeding in a safe and effective way. The speech therapy was based on the changes found in the different dysphagia severity ratings, using strategies of indirect and direct therapy: inadequate lip seal, oral motor incoordination, difficulty in ejection of the bolus, premature escape of liquid and/or food to the pharyngeal region, incomplete or weakened laryngeal elevation, weakness in the pharyngeal muscles, shortness of breath and changes in the vocal quality.

First, a descriptive analysis of the distribution of frequency for categorical variables and of the measures of central tendency and of dispersion for continuous variables was made. To compare the result of the first swallowing assessment in the hospital admission and at the time of hospital discharge, the chi-square or Fisher's exact test (when the number of events was less than 5) for categorical variables and the *Wilcoxon* test for continuous variables were used. The significance level of 5% was considered. All analyzes were

performed using the *Statistical Package for Social Sciences* (SPSS version 16.0).

## RESULTS

The socio-demographic and clinical characteristics are described in Table 1. There were 78% ischemic strokes and 22% hemorrhagic strokes, mainly involving the territory of the middle cerebral artery (47%). The main pathophysiological mechanism of the ischemic strokes was atherosclerosis (42.3%), followed by cardioembolic (28.3%) and lacunar strokes (18.0%). The most common comorbidity was hypertension (82.7%) and the history of previous stroke was present in 20% of the studied population<sup>32</sup>.

The average time in days between the initial speech evaluation and the evaluation held at the time of hospital discharge was 22.1 days (minimum of 8 days, maximum of 37 days). During this period there were five deaths.

Among the evaluations, there was an increase in the average score of the GUSS, indicating improvement of the swallowing ability. At the same time, a change in the distribution profile of the severity of dysphagia can be seen. In the initial evaluation, 28% of the patients presented severe dysphagia with a high risk of aspiration. At the time of hospital discharge, only 2.1% of the patients presented high risk of aspiration, being that 32.6% presented slight dysphagia and low risk of aspiration (Table 2).

In the final evaluation, the proportion of changes in swallowing was lower for saliva and semisolid, but higher for liquids and solids. There was a significant difference for solid texture (Table 3).

**Table 1.** Socio-demographic, clinical characteristics and comorbidities of post-stroke patients

Characteristics	Patients (N=100)	
	N or Average $\pm$ DPM	Proportion % or Mean (range)
<b>Gender</b>		
Male	46	46,0
Female	54	54,0
Age	62,6 $\pm$ 16,7	63,0 (13-94)
<b>Comorbidities</b>		
Prior stroke	20	20,0
Diabetes mellitus	24	24,5
Arterial hypertension	81	82,7
Heart diseases*	30	30,6
Alzheimer's Disease	1	1,0
Parkinson's Disease	4	4,0
Chagas Disease	2	2,0
Physical inactivity	53	57,0
Tobacco Smoking**	27	28,1
Alcohol consumption***	19	19,8
<b>Glasgow (N=83)</b>		
8-10	3	3,6
11-14	16	19,2
15	64	67,1
<b>Stroke Type</b>		
Ischemic	78	78,0
Hemorrhagic	22	22,0
<b>Location</b>		
LACI	18	23,0
TACI	28	35,8
PACI	19	24,3
POCI	13	16,6
<b>Pathophysiology</b>		
Atherosclerosis	33	42,3
Cardioembolic	22	28,2
Lacunar	18	23,0
Other etiologies	1	1,2
Undetermined etiology	4	5,1

N =number of patients; DPM= average standard deviation

\*IAM (N=9), Atrial fibrillation (N=8), Valvular disease (N=13) \*\* Less than 1 packet of cigarettes/day (N=7), 1 packet of cigarettes/day (N= 16) plus 1 packet of cigarettes/day (N= 4) \*\*\* Eventual use (N=11), abusive use (N= 8) ·ln mmHg; ·bpm (beats per minute); ·mpm (movements per minute)

The OCSP and Toast classifications are held only for ischemic stroke. Location according to OCSP classification: LACI – lacunar, TACI – total anterior circulation, PACI – partial anterior circulation, POCI – posterior circulation. Pathophysiology according to TOAST classification.

**Table 2.** Severity of dysphagia obtained by total score in the Gugging Swallowing Screen scale in the initial swallowing assessment and at the time of hospital discharge of post-stroke patients

GUSS Total score	Initial evaluation N=100		Hospital discharge N=95**	
	N or Average $\pm$ DPM	Proportion % or Mean (range)	N or Average $\pm$ DPM	Proportion % or Mean (range)
0 to 9	28	28,0	2	2,1
10 to 14	12	12,0	21	22,1
15 to 19	12	12,0	31	32,7
20	48	48,0	41	43,1
Total	100	100,0	95	100
Average	14,6 $\pm$ 6,9	19,5 (0,0-20,0)	17,9 $\pm$ 3,4	20,0 (2,0-20,0)
P value*	0,01			

N = number of patients; DPM: average standard deviation

\*\* 5 patients died

\* Wilcoxon test

**Table 3.** Score obtained for saliva swallowing and three food textures by the Gugging Swallowing Screen scale in the initial swallowing assessment and at the time of hospital discharge of post-stroke patients

GUSS Score in each step	Saliva		Semisolid				Liquid				Solid					
	Initial assessment		Hospital discharge		Initial assessment		Hospital discharge		Initial assessment		Hospital discharge					
	N=100%	N=95%	N=86%	N=93%	N=74%	N=92%	N=61%	N=72%								
0	6	6,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1	4	4,0	1	1,0	5	5,8	1	1,0	-	-	-	-	3	4,9	20	27,7
2	1	1,0	1	1,0	1	1,1	-	-	3	4,0	4	4,3	-	-	-	-
3	2	2,0	-	-	3	3,4	-	-	9	12,1	15	16,3	3	4,9	1	1,0
4	1	1,0	-	-	3	3,4	-	-	1	1,3	1	1,0	7	11,4	10	13,8
5	86	86,0	93	98,0	74	86,0	92	98,0	61	82,4	72	78,0	48	78,6	41	57,0
P value*	0,46		1,00				0,72				0,01					

N = number of patients.

\*Fisher's Exact Test

## DISCUSSION

According to data from national and international literature, the most common stroke in this sample was ischemic, mainly involving atherosclerotic mechanism and anterior circulation<sup>32</sup>.

In Brazilian studies, a variation between 48 and 91% was observed in the frequency of post-stroke dysphagia, possibly reflecting different diagnostic protocols and moments of evaluation of swallowing (acute x subacute x chronic phase)<sup>10-16</sup>.

In this study, a high frequency of post-stroke dysphagia (52%) was observed among patients, being that 28% of them were diagnosed with severe dysphagia with high risk of aspiration. At the time of hospital discharge, there was a decrease in the severity of dysphagia.

It is noteworthy that 20% of the patients have a history of stroke prior to hospitalization and can influence this high number of patients with dysphagia in the initial swallowing assessment. This is because previous stroke is defined in the literature as a predictor of dysphagia after stroke<sup>2,13,30</sup>.

However, regardless of the presence or not of previous stroke, the evolution of swallowing during hospital stay showed a reduction in the frequency of dysphagia and change in the swallowing profile, confirming previous works<sup>28-31</sup>. This indicates the importance of clearly defining the moment of evaluation of swallowing, which is not always clear in the studies<sup>10-16</sup>, since its profile changes according to the stroke phase.

The GUSS<sup>27</sup> is a simple evaluation that allows the classification of dysphagia with individualized and serial evaluations of the three basic textures. The GUSS

does not classify dysphagia as a change in oral and/or pharyngeal phase, unlike other tools concerned with data on the speech organs and swallowing biomechanics<sup>9,11-16</sup>. This is because the dysphagia study in post-stroke patients in the acute phase should mainly focus the evaluation of the risk of bronchial aspiration and subsequent definition of a safer and more effective oral feeding<sup>1,3-5,9,27</sup>. In this study, the GUSS scale allowed not only the identification of dysphagia, but also the classification of its severity and clinical changes of the acute phase of stroke.

However, as the GUSS scale is a screening protocol as well as other clinical tools, it cannot identify silent aspiration, which is evidenced by objective tests<sup>2,17,27,29</sup>. Some researchers support the idea that the screening performed by the speech therapist is significantly more accurate when compared to other professionals as it minimizes the error in the identification of the patient with or without dysphagia<sup>27,29</sup>.

Some studies show that dysphagia of neurological origin treated in the acute phase of the disease usually has very positive results<sup>9,24</sup>. It must be considered that, in the acute phase of the disease, in addition to rehabilitation, some other processes are involved such as partial regression of the damage and the transience of symptoms, resulting in their improvement. Apart from that, the early evaluation and the speech rehabilitation are essential because even if the dysphagia is transient, it can be reversed more quickly and with fewer complications, minimizing the risk of aspiration<sup>8,19,25</sup>.

Regarding the evaluated textures, most patients (86%) have benefited from oral feeding with semisolid food in the first evaluation. The intermediate texture (semisolid) seems to be ideal at this time as the patient does not need a refined oral motor control for the cohesion of the liquid in the oral cavity and neuromuscular energy to perform the chewing of solid food<sup>10,16,24-27</sup>. Some independent studies corroborate this statement<sup>23-27</sup>. Studies with videofluoroscopy show that acute stroke patients present more changes in the swallowing of liquids than in other textures<sup>23-27</sup>. This indicates the need to analyze not only the liquid diet as in most of the screening tools<sup>17-22</sup> but also other textures<sup>27</sup>.

This study highlights the significant number of patients involved, the early evaluation of swallowing and the use of a valid simple tool, able to test different textures. In this context, the speech evaluation with GUSS has allowed the early release of semisolid food and, consequently, the maintenance of post-acute

stroke patients exclusively with oral feeding, without the need for an alternative way of feeding. This gradual approach not only considers the severity of dysphagia, but also emphasizes the quality of life of the patient and reduction of hospital costs<sup>2,6,23-25,27</sup>.

Therefore, it is suggested that swallowing should be traced in all individuals with stroke by the team of speech therapists through a structured and valid protocol for the studied population. The early evaluation (within 48 hours) allows the identification of the signs and symptoms of dysphagia and the individualized treatment planning required for intervention.

## CONCLUSION

The early speech evaluation using a structured protocol allows the treatment planning required for an intervention to mitigate the severity of post-stroke dysphagia, enabling the safe use of oral pathway and prevention of pulmonary complications.

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## APPENDIX – Gugging Swallowing Screen (GUSS)

## GUSS

(Gugging Swallowing Screen)

Name: \_\_\_\_\_  
Date: \_\_\_\_\_  
Time: \_\_\_\_\_

## 1. Preliminary Investigation/Indirect Swallowing Test

	YES	NO
<b>Vigilance</b> (The patient must be alert for at least for 15 minutes)	1 <input type="checkbox"/>	0 <input type="checkbox"/>
<b>Cough and/or throat clearing</b> ( <i>voluntary cough</i> ) (Patient should cough or clear his or her throat twice)	1 <input type="checkbox"/>	0 <input type="checkbox"/>
<b>Saliva Swallow:</b>	1 <input type="checkbox"/>	0 <input type="checkbox"/>
• Swallowing successful		
• Drooling	0 <input type="checkbox"/>	1 <input type="checkbox"/>
• Voice change (hoarse, gurgly, coated, weak)	0 <input type="checkbox"/>	1 <input type="checkbox"/>
<b>SUM:</b>	(5)	
	1 - 4= Investigate further* 5= Continue with part 2	

## 2. Direct Swallowing Test (Material: Aqua bi, flat teaspoon, food thickener, bread)

In the following order:	1 →	2 →	3 →
	SEMISOLID*	LIQUID**	SOLID ***
<b>DEGLUTITION:</b>			
▪ Swallowing not possible	0 <input type="checkbox"/>	0 <input type="checkbox"/>	0 <input type="checkbox"/>
▪ Swallowing delayed (> 2 sec.) (Solid textures > 10 sec.)	1 <input type="checkbox"/>	1 <input type="checkbox"/>	1 <input type="checkbox"/>
▪ Swallowing successful	2 <input type="checkbox"/>	2 <input type="checkbox"/>	2 <input type="checkbox"/>
<b>COUGH (involuntary):</b> (before, during or after swallowing - until 3 minutes later)			
▪ Yes	0 <input type="checkbox"/>	0 <input type="checkbox"/>	0 <input type="checkbox"/>
▪ No	1 <input type="checkbox"/>	1 <input type="checkbox"/>	1 <input type="checkbox"/>
<b>DROOLING:</b>			
▪ Yes	0 <input type="checkbox"/>	0 <input type="checkbox"/>	0 <input type="checkbox"/>
▪ No	1 <input type="checkbox"/>	1 <input type="checkbox"/>	1 <input type="checkbox"/>
<b>VOICE CHANGE:</b> (listen to the voice before and after swallowing - Patient should speak „O“)			
▪ Yes	0 <input type="checkbox"/>	0 <input type="checkbox"/>	0 <input type="checkbox"/>
▪ No	1 <input type="checkbox"/>	1 <input type="checkbox"/>	1 <input type="checkbox"/>
<b>SUM:</b>	(5)	(5)	(5)
	1 - 4= Investigate further* 5= Continue Liquid	1 - 4= Investigate further* 5= Continue Solid	1 - 4= Investigate further* 5= Normal
<b>SUM:</b> (Indirect Swallowing Test AND Direct Swallowing Test)	----- (20)		

*	First administer ½ up to a half teaspoon Aqua bi with food thickener (pudding-like consistency). If there are no symptoms apply 3 to 5 teaspoons. Assess after the 5 <sup>th</sup> spoonful.
**	3, 5, 10, 20 ml Aqua bi - if there are no symptoms continue with 50 ml Aqua bi (Daniels et al. 2000; Gottlieb et al. 1996) Assess and stop the investigation when one of the criteria is observed!
***	Clinical: dry bread; FEES: dry bread which is dipped in coloured liquid
†	Use functional investigations such as Videofluoroscopic Evaluation of Swallowing (VFES), Fiberoptic Endoscopic Evaluation of Swallowing (FEES)

## GUSS

(Gugging Swallowing Screen)

## GUSS - EVALUATION

RESULTS	SEVERITY CODE	RECOMMENDATIONS
20 Semisolid / liquid and solid texture successful	Slight / No Dysphagia minimal risk of aspiration	<ul style="list-style-type: none"> <li>Normal Diet</li> <li>Regular Liquids (First time under supervision of the SLT or a trained stroke nurse!)</li> </ul>
15-19 Semisolid and liquid texture successful and Solid unsuccessful	Slight Dysphagia with a low risk of aspiration	<ul style="list-style-type: none"> <li>Dysphagia Diet (pureed and soft food)</li> <li>Liquids very slowly – one sip at a time</li> <li>Functional swallowing assessments such as Fiberoptic Endoscopic Evaluation of Swallowing (FEES) or Videofluoroscopic Evaluation of Swallowing (VFES)</li> <li>Refer to Speech and Language Therapist (SLT)</li> </ul>
10-14 Semisolid swallow successful and Liquids unsuccessful	Moderate dysphagia with a risk of aspiration	Dysphagia diet beginning with: <ul style="list-style-type: none"> <li>Semisolid textures such as baby food and additional parenteral feeding.</li> <li>All liquids must be thickened!</li> <li>Pills must be crushed and mixed with thick liquid.</li> <li>No liquid medication!</li> <li>Further functional swallowing assessments (FEES, VFES)</li> <li>Refer to Speech and Language Therapist (SLT)</li> </ul> Supplementation with nasogastric tube or parenteral
0-9 Preliminary investigation unsuccessful or Semisolid swallow unsuccessful	Severe dysphagia with a high risk of aspiration	<ul style="list-style-type: none"> <li>NPO (non per os = nothing by mouth)</li> <li>Further functional swallowing assessment (FEES, VFES)</li> <li>Refer to Speech and Language Therapist (SLT)</li> </ul> Supplementation with nasogastric tube or parenteral