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RISK FACTORS FOR SWALLOWING DYSFUNCTION IN STROKE PATIENTS

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ABSTRACT – ***Context*** - Stroke is a frequent cause of dysphagia. ***Objective*** - To evaluate in a tertiary care hospital the prevalence of swallowing dysfunction in stroke patients, to analyze factors associated with the dysfunction and to relate swallowing dysfunction to mortality 3 months after the stroke. ***Methods*** - Clinical evaluation of deglutition was performed in 212 consecutive patients with a medical and radiologic diagnosis of stroke. The occurrence of death was determined 3 months after the stroke. ***Results*** - It was observed that 63% of the patients had swallowing dysfunction. The variables gender and specific location of the lesion were not associated with the presence or absence of swallowing dysfunction. The patients with swallowing dysfunction had more frequently a previous stroke, had a stroke in the left hemisphere, motor and/or sensitivity alterations, difficulty in oral comprehension, alteration of oral expression, alteration of the level of consciousness, complications such as fever and pneumonia, high indexes on the Rankin scale, and low indexes on the Barthel scale. These patients had a higher mortality rate. ***Conclusions*** - Swallowing evaluation should be done in all patients with stroke, since swallowing dysfunction is associated with complications and an increased risk of death.

HEADINGS – Stroke. Deglutition disorders.

INTRODUCTION

Stroke is one of the major causes of disability in adults, causing cognitive, motor, speech, language and swallowing alterations[19].

Alterations of the oral, pharyngeal or esophageal phases of swallowing cause dysphagia. Oropharyngeal dysfunction is associated with severe forms of dysphagia[37], a common consequence of neurological disorders, among them stroke[7, 20, 22, 46].

Food aspiration is a frequent consequence of oropharyngeal dysphagia, involving a strong risk of pneumonia and interfering with feeding[15]. Thus, oropharyngeal dysphagia can impair nutrition, hydration, pulmonary status, eating pleasure and the social behavior of an individual, jeopardizing his quality of life[6] and leading to death, especially among elderly patients[29, 31, 45].

The pulmonary complications caused by aspiration are difficult to manage and the detection and characterization of aspiration occurring during the pharyngeal phase of swallowing are of primordial importance for prognosis and rehabilitation, with the condition being detected by clinical evaluation followed by exams such as videofluoroscopy or nasofibrolaryngoscopy[7, 20].

Although clinical evaluation has limitations, it plays an important role as an objective exam[19, 30, 33]. Thus, swallowing function should be evaluated in all stroke patients since oropharyngeal dysphagia is frequently present during the acute phase and may persist in many patients, giving rise to constant complications[22, 46]. The importance of clinical evaluation of swallowing increases in an underdeveloped country, where videofluoroscopy and nasofibrolaryngoscopy are not always available.

The objectives of the present study were: 1) to perform a clinical evaluation of oropharyngeal swallowing in patients with stroke, 2) to determine the prevalence of dysphagia in these patients, 3) to analyze possible predictive factors of swallowing changes such as age, gender, multiple or single lesions, type of stroke (ischemic or hemorrhagic), location of the lesion, oral expression, oral comprehension, level of consciousness, motor and/or sensory alterations, respiratory changes, presence of complications such as fever, pneumonia, and functional capacity, and 4) to relate the presence of swallowing dysfunction to mortality 3 months after the stroke.

METHODS

The study was approved by the Research Ethics Committee of the University Hospital, Faculty

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of Medicine of Ribeirão Preto, University of São Paulo (HCFMRP–USP), Ribeirão Preto, SP, Brazil. All patients or their caregivers, when indicated, gave written informed consent to participate.

Swallowing was clinically evaluated by a speech therapist in 212 consecutive patients with cerebral vascular accident (CVA) from May 2005 to July 2006. All patients had been admitted to a tertiary hospital in a developing country and were submitted to routine neurological evaluation yielding a medical diagnosis of stroke which was then confirmed by neurological examination and imaging exams such as computed tomography (CT) and/or magnetic resonance imaging (MRI). A total of 172 patients (81.1%) were evaluated within 5 days after the stroke, 14 (6.6%) were evaluated between 11 and 20 days after the stroke, and 26 (12.3%) between 21 and 60 days after the stroke.

Inclusion criteria were: patients with a medical diagnosis of ischemic (CVAi) or hemorrhagic (CVAh) stroke confirmed by neurological examination and imaging exams, admitted to the Emergency Unit of HCFMRP-USP, with or without swallowing complaints. Patients with a clinical history of a previous stroke were not excluded.

Exclusion criteria were: patients presenting any other neurological or structural changes that might interfere with the swallowing process, patients with an inconclusive imaging exam, and patients in a coma and/or on clinical ventilation, with no possibility of clinical evaluation of swallowing.

Swallowing dynamics was observed during functional evaluation. According to the possibilities and acceptance of the patient, a sample of liquid consistency (3, 5, 7 mL and/or a free volume of water), of paste consistency (3, 5, 7 mL and/or a free volume of thickened juice) and of solid consistency (free volume of cracker or bread) was offered, or the general diet of the patient (meal) containing these consistencies. The following features were observed: presence or absence of lip sealing, extraoral food escape, nasal reflux, residue in the oral cavity after swallowing, altered cervical auscultation, altered laryngeal elevation, change in vocal quality, respiratory changes, cough, choking, fatigue, need for multiple swallows, compensatory maneuver during swallowing, and escape of stained food through the tracheostomy evaluated by the blue dye test[28] in patients with a tracheostomy.

Swallowing dysfunction was considered to be present in all patients showing one or more changes in the items described above. After this bedside evaluation, the patients were divided into two groups: group I (gI), patients without swallowing alterations, and group II (gII), patients with swallowing alterations. Based on the degree of alteration, patients were classified as presenting mild, moderate or severe swallowing impairment[38].

- Mild swallowing impairment: delayed, slow control and transport of the bolus, with no signs of laryngeal penetration upon cervical auscultation.

Findings: anterior extraoral food escape, delayed triggering of swallowing, absence of cough, no marked reduction of laryngeal elevation, with no change in vocal behavior after swallowing, and normal cervical auscultation.

- Moderate swallowing impairment: delayed, slow control and transport of the bolus, with signs of laryngeal penetration upon cervical auscultation and risk of aspiration.

Findings: anterior extraoral food escape, delayed or absent swallowing, presence of cough before, during and after swallowing, reduction of laryngeal elevation, altered vocal behavior after swallowing, and altered cervical auscultation.

- Severe swallowing difficulty: presence of substantial aspiration and absence of complete swallowing of the food bolus.

Findings: delayed or absent swallowing, reduction of larynx elevation, presence of cough during and after swallowing, altered vocal behavior after swallowing, clearly visible respiratory alteration, altered cervical auscultation, and incomplete swallowing.

The Barthel index of activities of daily living[21] and the Rankin scale[33] were applied to all patients. The scale of daily life Barthel index checks how the patient is independent, taking into account the following: bathing, dressing, personal hygiene, stools (incontinence), urination, passing from bed to chair, walking, going through stairs. The Rankin scale takes into consideration the ability of the patient to perform daily life activities, ranging from no disability (able to perform all usual activities) to severe disability (restricted to a bed or chair, often incontinent, requiring constant aid and nursing care).

The volume of the hematoma[17], the intracerebral hemorrhage (ICH) score[14] and the specific location of the stroke were analyzed in patients with hemorrhagic stroke. In patients with ischemic stroke, the territory, location and extension of the lesion, cerebral artery involved and presence of old lesions were observed and defined according to the classification of Goldstein[10]. CT and/or MRI, which is routinely applied to patients, were analyzed together with a neurologist from the hospital staff.

The results of clinical evaluation were compared on the basis of the following variables: age, gender, multiple or single lesions, type of stroke (ischemic or hemorrhagic), location of the lesion, oral expression, oral comprehension, level of consciousness, motor and/or sensory changes, respiratory changes, presence of complications such as fever and pneumonia, and functional capacity. Three months after the stroke, the occurrence of death was determined by analysis of the medical records.

Data were analyzed statistically by the odds ratio (OR), with the 95% confidence interval (CI) as a measure of the association between the variables analyzed. The analysis was done by the Center of Quantitative Analysis of the Medical School of Ribeirão Preto, USP (CEMEQ).

RESULTS

Clinical evaluation revealed that 78 patients (37%) did not present swallowing alterations (gI) and 134 (63%) presented some swallowing changes (gII). In gII, swallowing alterations were mild in 26 patients (19%), moderate in 51 (38%), and severe in 57 (43%). GI consisted of 46 (59%) men and 32

(41%) women with a mean age of 62 years, and gII consisted of 79 (59%) men and 55 (41%) women with a mean age of 65 years. Swallowing dysfunction was considered to be present in all patients who presented one or more alterations upon clinical examination. The association between the variables analyzed and the presence or absence of swallowing dysfunction is presented in Table 1.

Statistical analysis of the present data revealed that variables such as gender, age or type of stroke (ischemic or hemorrhagic) were not associated with the presence or absence of swallowing dysfunction.

Patients who needed oxygen had an increased chance to have swallowing dysfunction (OR: 79.8), but the CI was large suggesting that the number of subjects who needed oxygen was not sufficient to reach an accurate conclusion.

Patients with a greater chance of presenting swallowing dysfunction when submitted to clinical evaluation were those with previous episodes of stroke (OR: 2.3), changes in oral expression such as dysarthria, aphasia and/or speech apraxia (OR: 6.8), altered consciousness level (OR: 24.2), altered oral comprehension (OR: 11.7), motor and/or sensory alterations (OR: 5.2), complications such as fever and/or pneumonia (OR: 11.0), high scores on the Rankin scale and low scores on the Barthel scale, and stroke in the left hemisphere (OR: 3.5).

TABLE 1. Results obtained for stroke patients without swallowing difficulties (group I) and with swallowing difficulties (group II)

		Swallowing				OR	95% CI	
		Group I		Group II				
		n	%	n	%			
Sex	Male	46	59.0	79	59.0	1		
	Female	32	41.0	55	41.0	1.00	0.57	1.76
Age range	< 60 years	32	41.0	40	29.9	1		
	≥ 60 years	46	59.0	94	70.1	1.63	0.91	2.93
Type of CVA	Ischemic	69	88.5	108	80.6	1		
	Hemorrhagic	9	11.5	26	19.4	1.85	0.82	4.17
CVA	First	62	79.5	84	62.7	1		
	Previous	16	20.5	50	37.3	2.31	1.2	4.42
Time of lesion	0 to 5 days	70	89.7	102	76.1	1		
	More than 5 days	8	10.3	32	23.9	2.74	1.19	6.31
Hemisphere	Right	33	42.3	59	44.0	2.53	1.08	5.94
	Left	23	29.5	56	41.8	3.45	1.42	8.35
	Bilateral	5	6.4	7	5.2	1.98	0.51	7.77
	Undetermined	17	21.8	12	9.0	1		
Oral expression	Unchanged	40	51.3	18	13.4	1		
	Altered	38	48.7	116	86.6	6.78	3.48	13.2
Consciousness	Alert	77	98.7	102	76.1	1		
	Some alteration	1	1.3	32	23.9	24.2	3.23	180.7
Comprehension	Unchanged	72	92.3	68	50.8	1		
	Altered	6	7.7	66	49.3	11.7	4.74	28.62
Sensorimotor alteration	Absent	13	16.7	5	3.7	1		
	Present	65	83.3	129	96.3	5.16	1.76	15.1
Respiration	Without oxygen aid	78	100.0	89	66.4	1		
	With oxygen aid	0	0.0	45	33.6	79.8	4.84	1317.11
Complications	Absent	76	97.4	104	77.6	1		
	Present	2	2.6	30	22.4	11	2.54	47.28
Classification by the Barthel index	Independent	21	26.9	6	4.5	1		
	Mildly dependent	24	30.8	14	10.5	2.04	0.66	6.27
	Moderately dependent	16	20.5	14	10.5	3.06	0.96	9.74
	Severely dependent	6	7.7	15	11.2	8.75	2.36	32.47
	Totally dependent	11	14.1	85	63.4	27	8.97	81.53
Rankin classification	Grade I	19	24.4	4	3.0	1		
	Grade II	7	9.0	4	3.0	2.71	0.53	13.92
	Grade III	13	16.7	10	7.5	3.65	0.94	14.2
	Grade IV	28	35.9	23	17.2	3.90	1.16	13.1
	Grade V	11	14.1	93	69.4	40.2	11.55	139.64

OR = odds ratio; 95% CI = 95% confidence interval; CVA = cerebral vascular accident

No relation was observed between the territory involved and the classification of Goldstein, the specific localization of the CVAi and the presence or absence of swallowing dysfunction (Table 2).

There was no significant relation between hematoma volume, ICH score, specific location of ischemic strokes and the presence of swallowing alteration. Among the cases of hemorrhagic stroke, the hematoma volume was larger than 30 cm^3 and the ICH score was 3 only in patients with swallowing dysfunction (Table 3).

Three months after the stroke, 39 of the 212 patients studied had died, 4 of them from gI (5%) and 35 from gII (26%). The probability of mortality 3 months after the stroke was 6.5 times higher among patients with swallowing alterations than among patients showing no changes in swallowing upon clinical evaluation (Table 4).

TABLE 2. Results obtained for patients with an ischemic stroke without swallowing difficulties (group I) and with swallowing difficulties (group II)

			Swallowing				OR	95%CI
			Group I		Group II			
			n	%	n	%		
1)	Territory	Carotid	32	46.4	72	66.7	2.89	1.28	6.52
		Vertebrobasilar	19	27.5	18	16.7	1.22	0.47	3.15
		Undetermined	18	26.1	14	12.9	1.00		
		Carotid + vertebrobasilar	0	0.0	4	3.7	11.48	0.57	231.00
2)	Exam	1A	29	42.0	58	53.7	7.33	1.90	28.35
	Goldstein (2001)	1B	3	4.4	7	6.5	8.56	1.33	54.95
		1C	5	7.3	0	0.0	0.30	0.01	6.85
		2A	7	10.1	14	13.0	7.33	1.53	35.11
		3A	1	1.5	5	4.6	18.33	1.51	222.88
		5A	6	8.7	12	11.1	7.33	1.47	36.66
		6A	11	15.9	3	2.8	1.00		
		9A	0	0.0	1	0.9	9.86	0.32	43.00
		10A	7	10.1	8	7.4	4.19	0.82	21.40
3)	Specific site	1- middle cerebral artery	27	39.1	68	63.0	1.00		
		3-posterior cerebral artery	9	13.0	1	0.9	0.04	0.01	0.36
		5- thalamocapsular	4	5.8	1	0.9	0.10	0.01	0.93
		7- brain stem	2	2.9	5	4.6	0.99	0.18	5.43
		8- cerebellum	3	4.4	3	2.8	0.40	0.07	2.09
		10- lacuna	20	29.0	15	13.9	0.30	0.13	0.67
		11- basilar artery	3	4.4	7	6.5	0.93	0.22	3.85
		12- internal capsule (lacuna)	1	1.5	3	2.8	1.19	0.12	11.96
		13- insula (lacuna)	0	0.0	1	0.9	1.20	0.05	30.48
		1 and 3- middle and posterior cerebral arteries	0	0.0	4	3.7	3.61	0.19	69.39

OR = odds ratio; 95% CI = 95% confidence interval

TABLE 3. Results obtained for patients with a hemorrhagic stroke considering the absence (group I) or presence (group II) of swallowing difficulties as the variable

			Swallowing				OR	95%CI	
			Group I		Group II				
			n	%	n	%			
1)	Volume of the hematoma	≤ 30 cm^3	9	100.0	18	72.0	1.00		
		> 30 cm^3	0	0.0	7	28.0	7.70	0.40	149.80
2)	ICH score	0	3	33.3	6	24.0	1.00		
		1	3	33.3	8	32.0	1.33	0.20	9.08
		2	3	33.3	5	20.0	0.83	0.11	6.11
		3	0	0.0	6	24.0	7.00	0.30	164.40
3)	Specific site	1- thalamus	5	55.6	10	40.0	1.00		
		2- lentiform nucleus	1	11.1	5	20.0	2.50	0.23	27.57
		3- insula	1	11.1	4	16.0	2.00	0.17	22.95
		4- mesencephalic point	0	0.0	1	4.0	1.57	0.05	45.37
		5- caudate nucleus	0	0.0	1	4.0	1.57	0.05	45.37
		6- lentiform nucleus and external capsule	0	0.0	1	4.0	1.57	0.05	45.37
		7- external capsule	0	0.0	1	4.0	1.57	0.05	45.37
		8- frontal	0	0.0	1	4.0	1.57	0.05	45.37
		9- external and temporoparietal capsule	0	0.0	1	4.0	1.57	0.05	45.37
		10- parietal	1	11.1	0	0.0	0.17	0.01	5.04
		11- intraventricular	1	11.1	0	0.0	0.17	0.01	5.04

OR = odds ratio; 95% CI = 95% confidence interval; ICH = intracerebral hemorrhage score

TABLE 4. Mortality 3 months after a stroke among patients with no swallowing difficulties (group I) and patients with swallowing difficulties (group II)

	Mortality						
	Absent		Present		OR	95% CI	
Swallowing	n	%	n	%			
Group I	74	42.8	4	10.3	1		
Group II	99	57.2	35	89.7	6.54	2.23	19.21

OR = odds ratio; 95% CI = 95% confidence interval

DISCUSSION

In the present study, swallowing dysfunction was observed in 134 patients (63%). The prevalence of oropharyngeal dysphagia in patients with stroke reported in the literature varies widely from 23% to 91%[3, 5, 15, 22, 23, 27, 29, 34, 45]. This variation may be explained by the methods applied in the various studies, by the different severity and by the difference in the time of evaluation of patients with stroke.

Nineteen percent of the patients had mild swallowing difficulties, 38% had moderate difficulties and 43% severe difficulties. These values refer to clinical evaluation since no objective exam was used, which might have revealed silent aspirations not detected by clinical evaluation. Although the sensitivity and specificity of this evaluation is variable[43], with no detection of silent aspiration, its reliability has been widely reported[32], as well as its contribution to the diagnosis, planning during the objective exam and the definition of therapy[1, 16].

There are some published protocols to evaluate the intensity of dysphagia[4, 30, 38-40], but there is no perfect agreement between them[41], which indicates the need to discuss the importance of the protocols used to evaluate oropharyngeal dysphagia.

The age of the patients with and without swallowing alterations did not differ, in agreement with a previous study which detected no significant age difference between dysphagic and non-dysphagic patients[45]. However, some authors have reported that swallowing dysfunction more frequently occurs in older individuals, particularly in men older than 60 years[26, 37]. Thus, elderly patients with stroke may have more swallowing alterations and consequently a greater risk to develop pneumonia[25], due to the reduced cough reflex and alterations of swallowing/breathing coordination[24].

In the current study, patients with previous strokes had a greater chance to present swallowing dysfunction than patients who had a first episode, in agreement with previous results[25, 42]. The same was observed in patients with changes in oral expression such as dysarthria, aphasia and/or speech apraxia after the stroke. The presence of dysarthria associated with dysphagia has been reported by some authors[5, 6], but few studies have investigated the association of aphasia and apraxia with dysphagia[2, 36].

Patients with high scores on the Rankin scale and low scores on the Barthel scale, with motor and/or sensory changes and alteration of consciousness level and of oral comprehension after the stroke had a greater chance to present swallowing dysfunction. These results agree with previous reports which stated that brain lesions that cause changes in cognitive function such as concentration and attention may impair the control of swallowing[9].

In the present study, the relation between swallowing dysfunction and need for oxygen aid was not conclusive, although patients with breathing difficulties may present respiration/swallowing incoordination leading to the manifestation of oropharyngeal dysphagia, due to the fact that swallowing and breathing use the same structures and therefore require a fine degree of coordination. Neurological diseases accompanied by dysphagia may involve changes in respiration, representing a possible risk factor for aspiration[27].

Patients with complications such as fever and pneumonia had a greater chance to have swallowing dysfunction. The presence of dysphagia and aspiration, determined by clinical evaluation[18] or videofluoroscopy[46], increases the risk of pulmonary infection. Aspiration followed by pneumonia is the most important complication of dysphagia, affecting 1/3 of all dysphagic patients[22].

The type of stroke (ischemic or hemorrhagic) was not associated with the presence or absence of swallowing dysfunction, probably because the severity of the neurological disease observed after both hemorrhagic strokes and brain infarctions is determined by the location and size of brain damage.

Some authors agree with the statement that patients with a stroke located in the left hemisphere have more swallowing alterations. It was observed that a significant increase in the activation of the sensorimotor cortex occurs on the left compared to the right during swallowing[8]. However, most studies report that patients with lesions in the right hemisphere have more swallowing dysfunction[44]. It was described that lesions located in the right hemisphere cause more pharyngeal changes and that lesions in the left hemisphere cause more changes in the oral phase of swallowing[16]. Other studies on patients with stroke did not observe a relation between the presence of dysphagia and right or left hemispheric location[13, 29, 36, 46]. A study conducted on healthy volunteers revealed that the representation of swallowing occurs bilaterally in the motor cortex, although in an asymmetrical manner. This may raise the hypothesis that some patients have hemispheric dominance for swallowing, thus lesions in the dominant hemisphere are more likely to cause dysphagia[11].

No relation between specific lesion location and the presence or absence of swallowing difficulties was observed in CVAi or CVAh. Some studies have demonstrated that the location and severity of the lesion in patients with CVA determines the effect on swallowing[2], whereas others did not confirm the correlation between swallowing disorders and location of the lesion[12, 36].

Magnetic transcranial stimulation reveals that dysphagic patients with a unilateral stroke have lower pharyngeal representations in the unaffected hemisphere than patients with unaltered swallowing regardless of the depth of the lesion

(cortical or subcortical). These findings indicate interhemispheric asymmetry of swallowing motor function, suggesting that lesions in the hemisphere with a dominant swallowing center result more frequently in oropharyngeal dysphagia[11]. Recovery of swallowing in dysphagic patients after a CVA is associated with increased pharyngeal representation in the unaffected hemisphere, suggesting the possibility of reorganization of this hemisphere[12]. This may explain why some patients develop dysphagia and others do not despite the same location of the lesion[13]. In addition, the size of the lesion is considered to be more important than its location for the development of oropharyngeal dysphagia[29].

In the present study, the possibility of mortality was found to be higher among patients with swallowing dysfunction, as previously described[16], generally associated with aspirative pneumonia. Patients with dysphagia after a stroke are at a 6- to 7-fold higher risk to develop aspirative pneumonia and at a 3-fold higher risk to die[42].

CONCLUSIONS

The following factors were found to be predictors of swallowing difficulty after a stroke upon clinical evaluation:

1. Previous episodes of stroke
2. Changes in oral expression such as dysarthria, aphasia and/or speech apraxia
3. Altered level of consciousness such as somnolence or mental confusion
4. Altered oral comprehension
5. Motor and/or sensory alterations
6. Complications such as fever and pneumonia
7. High score on the Rankin scale and low score on the Barthel scale
8. Stroke in the left hemisphere

The possibility of mortality was higher in patients with altered swallowing than in patients with no such alteration upon clinical evaluation.

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RESUMO – ***Contexto*** - Disfagia orofaríngea é consequência frequente do acidente vascular encefálico (AVE). ***Objetivos*** - Avaliar clinicamente a prevalência de alterações da deglutição, analisar os fatores associados com a disfunção e relacionar a presença de dificuldade de deglutição com a mortalidade após 3 meses do acidente vascular em pacientes com AVE. ***Método*** - A deglutição foi avaliada clinicamente em 212 pacientes consecutivos com diagnóstico médico e radiológico de AVE. Após 3 meses foi verificada a ocorrência de óbito. ***Resultados*** - Entre os pacientes estudados, 63% apresentaram alteração da deglutição. As variáveis gênero e localização específica da lesão não estavam associadas à presença ou não de dificuldade de deglutição. Os pacientes com dificuldade de deglutição tinham: prévios episódios de AVE, AVE no hemisfério esquerdo, alterações motoras e/ou de sensibilidade, alterações na compreensão oral, expressão oral e nível de consciência, complicações como febre e pneumonia, e índices altos na escala de Rankin e baixos na escala de Barthel. Esses pacientes apresentaram maior mortalidade. ***Conclusões*** - A deglutição deve ser avaliada em todos os pacientes com AVE, considerando que alterações na deglutição estão associadas com complicações e com aumento na mortalidade.

DESCRITORES – Acidente vascular cerebral. Transtornos de deglutição.

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