

## ORIGINAL

# First-ever stroke patients in Suriname show more communication disorders than swallowing disorders and these depend on age and length of stay in hospital

*Los primeros pacientes con accidente cerebrovascular en Surinam muestran más trastornos de la comunicación que trastornos de la deglución y estos dependen de la edad y la duración de la estancia en el hospital.*

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Received: 13 - IX - 2022

Accepted: 13 - X - 2022

doi: 10.3306/AJHS.2023.38.01.23

## Abstract

**Objective:** Research on the occurrence of communication and swallowing disorders in first-ever stroke patients in Suriname is scant. This study aimed to determine the (co-) occurrence of speech-language pathology disorders following a first-ever stroke. Furthermore, it examined the association between age and length of stay with various speech-language pathology disorders.

**Methods:** Forty-three first-ever stroke patients admitted to the neurological unit of the Academic Hospital in Paramaribo were enrolled in this prospective study. Speech-language pathology screenings were performed within one week after admission. Occurrence rates were calculated as frequencies. Associations between variables of interest were calculated using the Mann-Whitney U test.

**Results:** Aphasia, dysarthria, apraxia of speech and dysphagia were present in 41.9%, 39.5%, 23.3% and 20.9% respectively. A co-occurrence of 7 to 28%, 20.9% and 2.3% was seen for two, three and four disorders, respectively. Age was significantly associated with apraxia of speech ( $p = .04$ ) and dysphagia ( $p = .04$ ) whereas length of stay was significantly associated with only dysphagia ( $p = .02$ ). Overall, the study showed the highest occurrence of aphasia, followed by dysarthria, AOS, and dysphagia.

**Conclusions:** Communication disorders are more common than swallowing disorders among first-ever stroke patients in Suriname. To serve these patients, there is an urgent need for standardized testing and rehabilitation.

**Keywords:** Aphasia, Dysarthria, Apraxia of Speech, Dysphagia, Stroke.

## Resumen

**Objetivo:** La investigación sobre la aparición de trastornos de la comunicación y la deglución en pacientes con primer accidente cerebrovascular en Surinam es insuficiente. Este estudio tuvo como objetivo determinar la coocurrencia de trastornos de la patología del habla y el lenguaje después de un primer accidente cerebrovascular. Además, examinó la asociación entre la edad y la duración de la estancia con diversos trastornos de la patología del habla y el lenguaje.

**Métodos:** Cuarenta y tres pacientes con ictus ingresados en la unidad neurológica del Hospital Académico de Paramaribo se inscribieron en este estudio prospectivo. Los exámenes de patología del habla y el lenguaje se realizaron dentro de una semana después de la admisión. Las tasas de ocurrencia se calculan como frecuencias. Se calcularon una asociación entre variables de interés mediante la prueba U de Mann-Whitney.

**Resultados:** Afasia, disartria, apraxia del habla y disfagia estuvieron presentes en 41.9%, 39.5%, 23.3% y 20.9% respectivamente. Se observó una coocurrencia de 7 a 28%, 20.9% y 2.3% para dos, tres y cuatro trastornos, respectivamente. La edad se asoció significativamente con apraxia del habla ( $p = 0,04$ ) y disfagia ( $p = 0,04$ ), mientras que la duración de la estancia se asoció significativamente solo con disfagia ( $p = 0,02$ ). En general, el estudio mostró la mayor incidencia de afasia, seguida de disartria, AOS y disfagia.

**Conclusión:** Los trastornos de la comunicación C son más comunes que los trastornos de la deglución entre los pacientes con primer accidente cerebrovascular en Surinam. Para atender a estos pacientes, existe una necesidad urgente de pruebas estandarizadas y rehabilitación.

**Palabras clave:** Afasia, Disartria, Apraxia del habla, Disfagia, Accidente cerebrovascular.

## Introduction

Stroke is a sudden and abrupt loss of brain function following an ischemic or hemorrhagic cerebrovascular injury. It can temporarily or permanently affect skills such as communication and swallowing. Depending on the type, location, and severity of the stroke, a variety of speech-language pathology (SLP) disorders such as aphasia, dysarthria, apraxia of speech (AOS) and swallowing disorders like dysphagia, can occur as a prolonged complication of the stroke. Consequently, these disorders can cause an additional burden on health and economy and have an impact on patients' quality of life.

Previous studies found that there is a large variability in the occurrence of these various SLP disorders. In a systematic review of Meng et al the pooled occurrence rate of dysphagia in stroke patients was 36.3%<sup>1</sup>. In other studies, this percentage ranged from 8.1% to 80%<sup>2</sup>. For dysarthria and aphasia, the occurrence rate in subacute stroke patients was reported to be 54.9% and 31.7%, respectively<sup>3</sup>. Similar results of a lower incidence of aphasia compared to dysarthria were reported in acute stroke patients<sup>4-6</sup>. Moreover, SLP disorders often co-occur in stroke patients and at least a third of the participants concomitantly showed up to two of these disorders. For instance, about 30% of the patients develop both dysarthria and aphasia<sup>4</sup> and this results in significantly less functional recovery than with the single occurrence of the two disorders<sup>7</sup>.

In addition to the (co)-occurrence of SLP disorders in stroke patients, studies also described the relationship between various factors and the presence or absence of these SLP disorders. For instance, extended hospitalization contributes significantly to a decreased quality of life in patients with dysphagia. Moreover, several studies point out that stroke patients with dysphagia have an extended hospital stay compared to stroke patients without dysphagia<sup>8-10</sup>. A recent review underscored this also for patients with aphasia<sup>11</sup>. Thus, it can be safely assumed that the severity of aphasia is inversely correlated with the length of stay in hospital. Age is another factor contributing to the severity of SLP disorders. An advanced age is associated with a higher prevalence and increased risk of aphasia<sup>12-17</sup>. Patients presenting with dysphagia were averagely older than the rest<sup>18,19</sup>.

Unfortunately, in Suriname, few if any scientific writings have been devoted to SLP disorders in stroke patients. In this study, we aim to close the gap by analyzing the (co)-occurrence of SLP disorders in Surinamese post-stroke patients. We also assess whether there is a relationship between age, or, length of hospital stay and the presence or absence of common SLP disorders in stroke patients. In line with current literature, we hypothesize different

types of SLP disorders will co-occur for at least 20%. In addition, there will be a relationship between higher age and increased LOS and the presence of especially dysphagia and aphasia.

## Method

### Participants

Recruitment of patients took place from April 1, 2019 to August 1, 2019 at the stroke unit of the Academic Hospital Paramaribo. Enrollment in the study was based on the following inclusion criteria: (1) a first-ever stroke as defined by the World Health Organization (WHO); (2)  $\geq 18$  years.

This study was approved by the Ministry of Health, "Commissie Mensgebonden Wetenschappelijk Onderzoek" (approval number DVG-055) for its feasibility as well as its ethical aspects. All patients or their legal representatives gave informed consent for the study and all procedures were carried out in accordance with the Declaration of Helsinki. Only de-identified data for those consenting to its use for research purposes are presented.

### Study procedures

All study procedures were carried out by trained SLPs during the participants' hospitalization, aided by nursing personnel whenever necessary. Demographic information such as age, sex, and date of birth, as well as clinical information were mainly collected from the medical records followed by oral interviews. Furthermore, participants included in the study completed all four screenings (i.e., aphasia, dysarthria, AOS, and dysphagia) within one week after admission to the hospital.

### Evaluation of aphasia

Aphasia was evaluated using the Token test. This validated and standardized tool consists of 36 items, which includes 20 tokens with different colors, sizes and shapes. For each item, the examinee must understand and respond to simple verbal commands by pointing out or moving tokens. The maximum score is 36 with a higher score indicating a better performance and a score less than 29 indicating the presence of aphasia<sup>20</sup>.

### Evaluation of dysarthria

Dysarthria was evaluated using the 'Nederlandstalig Dysartrisch Onderzoek voor Volwassenen' (NDO-V), which is a validated and standardized Dutch scale that is used for screening of dysarthria<sup>21</sup>. This scale provides information on various aspects of speech such as spontaneous speech, reading of standardized text, diadochokinetic, slide tones, shouting and speech holding time. Also, the type and severity of dysarthria is determined. At last, a differential diagnosis of dysarthria is made by the SLP based on a two-point scale with yes or no.

### Evaluation of AOS

AOS was evaluated using a self-developed perceptual evaluation based on direct and indirect characteristics. This evaluation included seven questions based on characteristics such as (1) initiation problems, (2) distortion of sounds, (3) sequence problems, (4) articulation problems, (5) slowed rate of speech, (6) prosodic impairments, and (7) problems in naming words<sup>22</sup>. These questions are rated on a two-point scale with yes or no. The presence of at least the necessary signs such as articulation problems, slowed rate of speech and prosodic impairments differentiated between patients with and without AOS.

### Evaluation of dysphagia

Dysphagia was evaluated using the Gugging Swallowing Screen (GUSS), which is a quick and safe clinical bedside tool to identify patients with dysphagia<sup>23</sup>. It consists of an indirect swallowing test followed by a direct swallowing test. The examinee should earn the maximum score of 5 for the indirect test in order to go further with the direct test. The total score of the GUSS is 20 with a score of ≤ 19 indicating the presence of dysphagia.

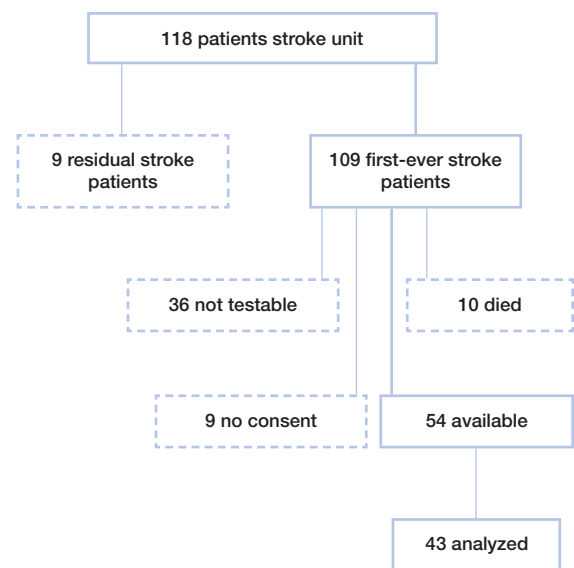
### Data analysis

Demographics and clinical characteristics were reported as median (interquartile range) or frequencies based on continuous or categorical variables. Furthermore, the first outcome of interest included estimates for the incidence and co-occurrence of aphasia, dysarthria, AOS and dysphagia and was calculated using frequency estimates and their 95% confidence intervals (CIs). To address the second outcome of interest, the relationship between age, or, LOS and the absence/presence of a specific SLP disorder (aphasia, dysarthria, AOS and dysphagia), Mann-Whitney U tests were conducted. All calculated p values were considered significant if less than .05. All statistical analyses were performed using IBM Statistical Package for Social Science (SPSS) version 25 (SPSS Inc., Chicago, IL, USA).

## Results

All 118 patients admitted to the stroke unit of the Academic Hospital Paramaribo between April 1, 2019 and August 1, 2019 were considered for inclusion in the present study (Figure 1). Nine patients were excluded because their symptoms were diagnosed to result from a residual stroke. From the remaining 109 first-ever stroke patients, 36 were excluded because they were not testable, while 10 died within the testing period. Finally, nine patients did not provide consent. As a result, a total of 54 first-ever stroke patients could be tested for their communication and swallowing skills. Of these, 11 patients did not complete the study procedure, and, therefore, were excluded for the analysis. Therefore, 43 patients were included in the final analysis. Patient demographics and

Figure 1: Flow chart of patient selection.



Note: Boxes with dotted lines indicate subjects excluded from the study removed from the analysis.

Table I: Demographics and clinical characteristics of participants.

Variable	Total participants, N = 43
<b>Demographics</b>	
Age in years, median (IQR)	61.74 (20.82)
Male, n (%)	22 (51.2%)
<b>Ethnicity, n (%)</b>	
Creole	18 (41.9%)
Hindustani	16 (37.2%)
Javanese	6 (14%)
Maroon	0 (0.0%)
Other	3 (7%)
<b>Stroke pathogenesis, n (%)</b>	
Cerebral infarction	25 (58.1%)
Intracerebral hemorrhage	2 (4.7%)
Not specified	16 (37.2%)
<b>Side hemiparesis, n (%)</b>	
Left	15 (34.9%)
Right	10 (23.3%)
Unknown	18 (41.9%)
Length of stay (days), median (IQR)	8 (11)

IQR, interquartile range

Table II: Incidence and co-occurrence of four disorders.

Disorder(s)	Total participants, N = 43
<b>Incidence</b>	
	% (n)
Aphasia	41.9% (18)
Dysarthria	39.5% (17)
AOS	23.3% (10)
Dysphagia	20.9% (9)
None	37.2% (16)
<b>Co-occurrence</b>	
Aphasia + dysarthria	27.9% (12)
Dysarthria + AOS	20.9% (9)
AOS+ Aphasia	16.3% (7)
Aphasia + dysphagia	9.3% (4)
Dysphagia + dysarthria	7.0% (3)
Dysphagia + AOS	7.0% (3)
3 combined	20.9% (9)
All 4	2.3% (1)

clinical characteristics are shown in **table I**. The mean age of the patients was 60 (SD 15; range 19-87) years and 51% were male. The mean LOS was 11 days (SD 10; range 2-47). Furthermore, most patients were from African (41.9%) or South Asian origin (37.2%). For approximately half of the patients (41.9%), the side of hemiparesis was not documented. The majority of patients (58.1%) suffered from an ischemic stroke while only a few patients (4.7%) had an intracerebral hemorrhage pathogenesis. For nearly 37.2%, the stroke pathogenesis was unknown.

First, the occurrence rates of the different SLP disorders, displayed in **table II**, were determined. The highest rate was aphasia with 41.9% of participants experiencing this SLP disorder following a first-ever stroke (95% CI [27.0%-57.8%]), followed by dysarthria with 39.5% of participants (95% CI [25%-55.9%]), AOS with 23.3% of participants (95% CI [11.8% - 38.6%]) and dysphagia with 20.9% of participants (95% [10.0%-36.0%]).

The co-occurrence of two disorders ranged from 7 to 28%, the latter percentage referring to the co-occurrence of aphasia and dysarthria. 20.9% of the patients showed a co-occurrence of three disorders, while only 2.3% showed a combination of all four disorders.

Second, the association between age and LOS with the different SLP disorders is seen in **table III**. Results of the Mann-Whitney U test showed significant differences in median age between patients with and without at least one of the examined SLP disorders ( $U=124, p=.02$ ), with the SLP disordered patient group showing a higher median age than the patient group without any SLP disorder. Differences in median LOS between both patient groups were also significant ( $U=126, p=.02$ ), with a higher median LOS in the SLP disordered patient group.

When focusing on the SLP disorders separately, results indicated that the median age of patients with AOS was significantly higher than the median age of patients without AOS ( $U=92, p=.04$ ). The same patterns was observed for patients with dysphagia as compared to

patients without dysphagia ( $U=83, p=.04$ ). No significant differences in median age were found for patients with/without aphasia ( $U=161, p=.12$ ) and for patients with/without dysarthria ( $U=166, p=.18$ ). For the median length of stay, only patients with and without dysphagia showed a significant difference ( $U=78, p=.02$ ). No significant differences were found between patients with/without AOS ( $U=161, p=.91$ ), patients with/without dysarthria ( $U=181, p=.31$ ) and patients with/without aphasia ( $U=180, p=.28$ ).

## Discussion

In this study, we first assessed the (co)-occurrence of the different SLP disorders in first-ever stroke patients in Suriname. In our sample, the highest occurrence rate was found for aphasia, while the lowest occurrence rate was found for dysphagia. In other studies, dysphagia showed the highest occurrence followed by dysarthria and aphasia<sup>6,5,24,25</sup>. This contrasting finding could have several reasons. First, in our sample, there could be an underestimation of dysphagia since assessments were carried out at one-week post stroke with patients already having spontaneous recovery. In other studies, assessment of dysphagia was mostly carried out within 72 hours. Second, the different occurrence pattern in our sample could potentially be linked to severity of stroke or lesion location. However, to date, no data are available on stroke severity and lesion location in Surinamese stroke patients. Indeed, currently, stroke severity is not consequently included in assessment protocols of the specialist and lesion location is not always specified. Thus, documentation of stroke severity and lesion location is extremely poor.

In addition, we observed the highest co-occurrence for aphasia with dysarthria. The co-occurrence of dysarthria with AOS and the co-occurrence of three SLP disorders accounted for the second highest co-occurrence rate. This indicates that communication disorders were very prevalent in our sample. These results are in line with other studies<sup>5,25</sup>

**Table III:** Median age and length of stay for the various speech and swallowing disorders.

	N	Age	95%	CI	p	LOS	95%	CI	p
0 disorders	16	53.55	43.8	67.8		6	4	8	
> 0 disorders	27	67.42*	59.3	73.4	0.02	12*	8	16	0.02
Aphasia -	25	56.2	50	67		7	6	14	
Aphasia +	18	68.6	61.6	73.4	0.11	10.5	8	16	0.27
Dysarthria -	26	56.7	50	69.5		7	6	11	
Dysarthria +	17	67.4	59.3	71.3	0.18	12	6	16	0.31
AOS-	33	57.3	52.6	66.6		3	2	5	
AOS+	10	70.2*	53.1	85.5	0.04	4	1	6	0.91
Dysphagia-	34	58.3	52.6	67.8		7	5	12	
Dysphagia+	9	69.5*	57.2	85.5	0.04	14*	10	30	0.02

**Note.** The Mann-Whitney non-parametric unpaired two way t-test was used because of the small numbers.

\* $p<0.05$

Secondly, our study examined the relationship between age and LOS with the presence or absence of (one of the) SLP disorders. For LOS, our results are partially in line with other studies. In these studies an extended LOS was associated with only dysphagia<sup>26,8,9,10,11</sup>. We only found that relationship between LOS and the presence/absence of dysphagia.

In line with other studies, in our sample there was also a significant association between the age of stroke patients and SLP disorders<sup>14,15,16,17</sup>.

This study is the first in Suriname to document the (co-)occurrence of SLP disorders after a first-ever stroke using standardized measurements as part of a well-founded diagnostic protocol.

One of the limitations of this study, however, was that the evaluation of dysphagia could not be carried out within 72 hours after the stroke. Another limitation was that basic (medical) information such as stroke severity, type and location of stroke was not well documented. This makes it difficult to interpret some of the differences with previous studies in the same domain, however, other contexts.

## Conclusion

Results from this study identified communication disorders to be prominent compared to swallowing disorders in first-ever stroke patients in Suriname.

Aphasia seems to be the most common SLP disorder. Moreover, our study confirmed an association of LOS with aphasia and dysphagia. Given the fact that aphasia has a major impact on one's quality of life, future studies in Suriname should further document the severity of aphasia patients.

At the same time, standardized assessment and treatment methods, i.e. clinical guidelines, adapted to the local context should be further optimized with the potential to facilitate future treatment advances for stroke patients in Suriname. Given the key role of SLPs in rehabilitation services after stroke, other known barriers such as a national policy to support SLP provisions should also be targeted.

## Acknowledgements

We thank the departments SLP and Neurology of the Academic Hospital Paramaribo for their support to carry out this study with stroke patients of the department Neurology.

## Funding details

VLIR-SOUTH Initiative, project number SR2018SIN230B135.

## Declaration of conflicting interest

The author(s) declare(s) that there is no conflict of interest.

## References

1. Meng P ping, Zhang S chao, Han C, Wang Q, Bai G tao, Yue S wei. The Occurrence Rate of Swallowing Disorders After Stroke Patients in Asia: A PRISMA-Compliant Systematic Review and Meta-Analysis. *J Stroke Cerebrovasc Dis* [Internet]. 2020 Oct 1 [cited 2022 Oct 5];29(10). Available from: <https://pubmed.ncbi.nlm.nih.gov/32912517/>
2. Arnold M, Liesirova K, Broeg-Morvay A, Meisterermt J, Schlager M, Mono ML, et al. Dysphagia in acute stroke: Incidence, burden and impact on clinical outcome. *PLoS One* [Internet]. 2016 Feb 1 [cited 2021 Jun 12];11(2). Available from: <https://pubmed.ncbi.nlm.nih.gov/26863627/>
3. Falsetti P, Acciai C, Palilla R, Bosi M, Carpinteri F, Zingarelli A, et al. Oropharyngeal Dysphagia after Stroke: Incidence, Diagnosis, and Clinical Predictors in Patients Admitted to a Neurorehabilitation Unit. *J Stroke Cerebrovasc Dis* [Internet]. 2009;18(5):329-35. Available from: <http://dx.doi.org/10.1016/j.jstrokecerebrovasdis.2009.01.009>
4. Ali M, Lyden P, Brady M. Aphasia and dysarthria in acute stroke: Recovery and functional outcome. *Int J Stroke*. 2015;10(3):400-6.
5. Flowers HL, Silver FL, Fang J, Rochon E, Martino R. The incidence, co-occurrence, and predictors of dysphagia, dysarthria, and aphasia after first-ever acute ischemic stroke. *J Commun Disord* [Internet]. 2013;46(3):238-48. Available from: <http://dx.doi.org/10.1016/j.jcomdis.2013.04.001>
6. Bahia MM, Mourão LF, Chun RYS. Dysarthria as a predictor of dysphagia following stroke. *NeuroRehabilitation*. 2016;38(2):155-62.
7. Kim G, Min D, Lee E ok, Kang EK. Impact of co-occurring dysarthria and aphasia on functional recovery in post-stroke patients. *Ann Rehabil Med*. 2016;40(6):1010-7.
8. Lakshminarayan K, Tsai A, Tong X, Vazquez G, Peacock J, George M, et al. Use of dysphagia screening results in predicting poststroke pneumonia. *Stroke*. 2010;41(12):2849-57.
9. Alsumrain M, Melillo N, Debari VA, Kirmani J, Moussavi M, Doraiswamy V, et al. Predictors and Outcomes of Pneumonia in Patients With Spontaneous Intracerebral Hemorrhage. *J Intensive Care Med*. 2013;28(2):118-23.

10. Joundi RA, Martino R, Saposnik G, Giannakeas V, Fang J, Kapral MK. Predictors and Outcomes of Dysphagia Screening after Acute Ischemic Stroke. *Stroke*. 2017;48(4):900-6.
11. Flowers HL, Skoretz SA, Silver FL, Rochon E, Fang J, Flamand-Roze C, et al. Poststroke Aphasia Frequency, Recovery, and Outcomes: A Systematic Review and Meta-Analysis. *Arch Phys Med Rehabil [Internet]*. 2016;97(12):2188-2201.e8. Available from: <http://dx.doi.org/10.1016/j.apmr.2016.03.006>
12. Dickey L, Kagan A, Lindsay MP, Fang J, Rowland A, Black S. Incidence and profile of inpatient stroke-induced aphasia in Ontario, Canada. *Arch Phys Med Rehabil*. 2010;91(2):196-202.
13. Bersano A, Burgio F, Gattinoni M, Candelise L. Aphasia burden to hospitalised acute stroke patients: need for an early rehabilitation programme. *Int J Stroke*. 2009;4(6):443-7.
14. Kadojic D, Bijelic BR, Radanovic R, Porobic M, Rimac J, Dikanovic M. Aphasia in patients with ischemic stroke. *Acta Clin Croat*. 2012;51(2):221-5.
15. Engelter ST, Gostynski M, Papa S, Frei M, Born C, Ajdacic-Gross V, et al. Epidemiology of aphasia attributable to first ischemic stroke: Incidence, severity, fluency, etiology, and thrombolysis. *Stroke*. 2006;37(6):1379-84.
16. De Cock E, Batens K, Hemelsoet D, Boon P, Oostra K, De Herdt V. Dysphagia, dysarthria and aphasia following a first acute ischaemic stroke: incidence and associated factors. *Eur J Neurol [Internet]*. 2020 Oct 1 [cited 2021 Jun 12];27(10):2014-21. Available from: <https://pubmed.ncbi.nlm.nih.gov/32515514/>
17. Lima RR, Rose ML, Lima HN, Cabral NL, Silveira NC, Massi GA. Prevalence of aphasia after stroke in a hospital population in southern Brazil: a retrospective cohort study. *Top Stroke Rehabil [Internet]*. 2020 Apr 2 [cited 2021 Jun 12];27(3):215-23. Available from: <https://pubmed.ncbi.nlm.nih.gov/31687916/>
18. de Souza Oliveira-Kumakura AR, da Silva KCR, Sousa CMFM, Biscaro JA, Spagnol GS, Morais SCRV. Content validation of clinical evidence related to self-care deficits of patients with stroke. *Rehabil Nurs J*. 2020;45(6):332-9.
19. Henke C, Foerch C, Lapa S. Early Screening Parameters for Dysphagia in Acute Ischemic Stroke. *Cerebrovasc Dis*. 2017;44(5-6):285-90.
20. Moreira L, Malloy-Diniz LF, Schlottfeldt CG, de Paula JJ, Coutinho G, Salgado JV, et al. Normative study of the Token Test (short version): Preliminary data for a sample of Brazilian seniors. *Rev Psiquiatr Clin*. 2011;38(3):97-101.
21. Knuijt S, Kaif H, de Swart B, van Gerven M, Kocken J, Kromhout L, et al. Nederlandstalig Dysartrieonderzoek voor volwassenen (NDO-V). *Ned Dysartrieonderzoek voor volwassenen*. 2014;
22. Jonkers R, Feiken J, Stuive I. Diagnosing apraxia of speech on the basis of eight distinctive signs. *Can J speech-language Pathol Audiol*. 2017;41(3):303-19.
23. Trapl M, Enderle P, Nowotny M, Teuschl Y, Matz K, Dachenhausen A, et al. Dysphagia bedside screening for acute-stroke patients: The gugging swallowing screen. *Stroke*. 2007;38(11):2948-52.
24. Jani MP, Gore GB. Occurrence of communication and swallowing problems in neurological disorders: Analysis of forty patients. *NeuroRehabilitation [Internet]*. 2014 [cited 2021 Jun 13];35(4):719-27. Available from: <https://pubmed.ncbi.nlm.nih.gov/25318773/>
25. Stipancic KL, Borders JC, Brates D, Thibeault SL. Prospective investigation of incidence and co-occurrence of dysphagia, dysarthria, and aphasia following ischemic stroke. *Am J Speech-Language Pathol [Internet]*. 2019 Feb 1 [cited 2021 Jun 13];28(1):188-94. Available from: <https://pubmed.ncbi.nlm.nih.gov/31072162/>
26. Teasell R, Foley N, Fisher J, Finestone H. The incidence, management, and complications of dysphagia in patients with medullary strokes admitted to a rehabilitation unit. *Dysphagia*. 2002;17(2):115-20.