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Verbal Communication Disorders Following a First Stroke Event: Types, Evolutive Aspects and Psychological Experience in Patients in Brazzaville, Congo

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Abstract: *Background*: Stroke causes a variety of disorders. These include verbal communication disorders (VCDs), which often lead to psychological and social problems that have a negative impact on patients' quality of life. *Objectives*: To determine the frequencies of post-stroke VCDs in Brazzaville; to describe the evolutive aspects of VCDs following speech therapy; to explore patients' psychological experience of VCDs. *Methods*: This was an analytical longitudinal study conducted from April 1 to August 31, 2022. It took place in Brazzaville, in the physical medicine and rehabilitation department of the university hospital and the functional rehabilitation department of the Makelekele referral hospital. It focused on patients who suffered from a first stroke event. The Boston Diagnostic Aphasia Examination-Third Edition, the Clinical Assessment Battery for Dysarthria, the Diagnostic Instrumental for Apraxia of Speech and interviews were used to assess VCDs. Speech therapy was used to treat post-stroke VCD. The Hospital Anxiety and Depression Scale, the Rosenberg Self-Esteem Scale and a questionnaire were used to identify the feelings experienced by patients. *Results*: From a total of 138 patients, 74 (53.6%) had a VCD. From these, 63 agreed to take part in the study. Of these 63 patients, 32 (50.8%), 27 (42.9%) and 4 (6.3%) had, respectively, aphasia, dysarthria and apraxia of speech. At 30 speech therapy sessions (3 months of speech therapy after stroke), 2 (6.3% of cases) aphasic patients, 12 (44.4% of cases) dysarthric patients and 1 (25% of cases) apraxic patient had completely recovered speech. Patients' psychological experience of VCD was characterized by frustration (90.5%), anxiety (71.4%), depression (71.4%), anger (69%), low self-esteem (45.2%), bad luck (35.7%), overprotection (35.7%), divine punishment (28.6%) and fatality (26.2%). *Conclusion*: In our study population, aphasia and dysarthria are the dominant VCDs, followed by apraxia of speech. The therapeutic strategies used to treat aphasia and apraxia of speech have led to very low rates of patients having completely recovered speech, suggesting the implementation of improved therapeutic measures to increase the degree of speech recovery. VCDs cause psychological problems, four of which predominate: frustration, anxiety, depression and anger.

Keywords: Stroke, Verbal Communication Disorders, Psychological Experience, Brazzaville

1. Introduction

Stroke is a chronic pathology caused by a disturbance in the blood supply to part of the brain. This disruption results either from the bursting of a blood vessel, either the blocking of a blood vessel, or a drop in blood flow pressure in the vessels supplying the brain due to a heart problem or systemic low blood pressure, causing damage to this part [1].

The damaged part of the brain is the cause of various disorders, such as motor deficiency, sensory deficiency, visual deficiency, mood disorders, dysphagia, bladder and bowel disorders, attention disorders, memory disorders, executive function disorders and verbal communication disorders (VCDs) [2].

The most common post-stroke VCDs are aphasia, dysarthria and apraxia of speech [3]. Aphasia is a language disorder that can affect speech comprehension, expression, writing and reading, and is related to damage to brain areas specialized in linguistic functions [2, 4]. Dysarthria is an articulatory disorder resulting from abnormal control of the movements of the oral-lingual-facial organs that enable speech production [2, 5, 6]. Apraxia of speech is defined as a disorder resulting from difficulty or inability to plan or program the sensorimotor commands required to voluntarily generate movements of the oral-lingual-facial organs to produce speech [2, 7].

VCDs cause psychological and social problems in patients [8, 9]. These problems have a negative impact on patients' quality of life, professional integration and self-reliance [3, 10-12].

Studies report a wide variation in the prevalence of post-stroke VCDs (20% - 70%) [1, 13-19].

VCDs affect both men and women. Gender does not appear to be associated with VCDs [20].

Factors associated with VCDs include the patient's advanced age, the stroke severity on admission, the neuroanatomical localization of the lesion and the size of the lesion [17, 20-27].

Various therapeutic approaches are used to enable stroke victims suffering from VCDs to either restore communication function or recover the deficient skill, or to compensate for communication function or increase patients' autonomy in acts of daily living. Their use takes into account the type of VCD, the degree of VCD severity and the post-stroke phase (acute, sub-acute and chronic) [2, 28-36].

Regression of post-stroke VCDs treated with appropriate therapies can be early and rapid (2 or 3 weeks after stroke) or more gradual (2, 4, 6, 8 or 12 months after stroke, or even years after stroke). The degree of speech and language recovery in post-stroke VCDs varies from individual to individual and depends on several factors, such as the type of VCD, the initial severity of VCD, the size of the brain lesion, and the neuroanatomical location of the lesion. In addition, good speech and language recovery is achieved when the diagnosis of VCD is made early [18, 37-44].

In Congo, the therapeutic approach used to enable stroke survivors suffering from VCD to recover speech is speech therapy. Moreover, only the study of quality of life in patients suffering from post-stroke aphasia is reported in literature [45]. There are no published data on the epidemiological, clinical, therapeutic and evolutive aspects of post-stroke VCDs, or on the psychosocial problems experienced by stroke survivors suffering from VCDs. The present study aims to improve the quality of life of patients suffering from post-stroke VCDs in Brazzaville. Its objectives are as follows: to determine the frequencies of post-stroke VCDs in Brazzaville; to describe the evolutive aspects of VCDs following speech therapy; to explore patients' psychological experience of VCDs.

2. Patients and Methods

This was an analytical longitudinal study conducted from April 1 to August 31, 2022. It was carried out in Brazzaville in the physical medicine and rehabilitation department of the university hospital and the functional rehabilitation department of the Makelekele referral hospital. The study population consisted of patients suffering from a first stroke event. The study protocol was approved by the Ethics Committee of the Health Sciences Research.

Inclusion criteria were patients: having a first stroke event confirmed by brain imaging and lasting no more than 3 months; having VCD; 18 years of age or older; who consented to participate in the study (in the case of a patient suffering from a severe VCD, written consent was obtained from family members).

Non-inclusion criteria were patients with: VCD prior to stroke, whatever the cause; VCD already managed; disorders of consciousness following stroke; psychiatric, visual and/or auditory disorders prior to stroke; no treatment evaluation at 10 speech therapy sessions (1 month of speech therapy after stroke), 20 speech therapy sessions (2 months of speech therapy after stroke) and 30 speech therapy sessions (3 months of speech therapy after stroke).

Patient recruitment was exhaustive. Information was collected using a data record. Study variables were demographic (age; gender; laterality; marital status; educational level; profession), clinical (type of stroke; site of brain lesion; topography of brain lesion; size of brain lesion; degree of stroke severity, assessed by NIHSS score; associated motor, sensory and/or sensory deficits; patient's degree of self-reliance at the start of speech therapy, assessed by the modified Rankin score), therapeutic (average time to speech therapy treatment; number of speech therapy sessions per week; duration of therapy sessions) and evolutive (number of patients resulting from the transformation of an initial severe clinical form into another less severe clinical form).

The Boston Diagnostic Aphasia Examination-Third Edition (BDAE-3) [46], the Clinical Dysarthria Evaluation Battery (CDEB) [47], the Diagnostic Instrumental for Apraxia of Speech (DIAS) [48] and interviews were used to assess VCDs.

Aphasia was considered: normal when the BDAE severity score was 5; mild when the BDAE severity score was 4; moderate when the BDAE severity score was 2 to 3; severe

when the BDAE severity score was 0 to 1.

Dysarthria was defined as: normal when the CDEB intelligibility score was 24; mild when the CDEB intelligibility score was 18 to 23; moderate when the CDEB intelligibility score was 12 to 17; severe when the CDEB intelligibility score was 7 to 11; massive when the CDEB intelligibility score was ≤ 6.

Information on patients' psychological experiences was investigated in patients free of language comprehension disorders. The absence of these disorders was defined by the logic and reasoning score of the auditory comprehension subscale of the BDAE. This score was ≥ 5.

Anxiety and depressive disorders were screened using the Hospital Anxiety and Depression Scale [49]. Overall self-esteem was assessed using the Rosenberg self-esteem scale [50].

To identify the feelings experienced by patients following a VCD, a questionnaire consisting of the following items was developed: frustration, anger, divine punishment, bad luck, overprotection and fatality (See: Appendix). The content of the questionnaire was validated by a team of researchers from the Faculty of Health Sciences at Marien N'Gouabi University.

Speech therapy was agreed with the patient and recorded in the patient's follow-up booklet. For aphasic patients, the techniques used were stimulation-facilitation combined with modality modelling [51, 52]. For dysarthric patients, the techniques used were the traditional analytical technique combined with neuromuscular proprioceptive stimulation [51]. For patients with apraxia of speech, the technique used was melodic intonation therapy [51, 53]. Patients were rehabilitated using languages commonly used, namely Lingala, Kituba and French language.

Data were collected using Excel. Data analysis was performed using SPSS 27.0 software. Qualitative and quantitative variables were expressed as percentages and mean ± standard deviation, respectively. The Kolmogorov test was used to assess the normality of the distribution. Comparisons of the numbers of independent variables were made using the Chi-square test or Fisher's exact test when the numbers were small. The Friedman test was used to compare the numbers of paired variables relating to the degree of severity of aphasia and dysarthria, comprising more than two modalities. The significance level was set at $p < 5\%$.

3. Results

From a total of 138 patients suffering from a first stroke event, 74 (53.6%) had VCD. Among these, 11 refused to participate in the study. Thus, 63 patients were included in the study, i.e. a participation rate of 85.1%.

Table 1 shows the demographic characteristics of the 63 patients. It shows a predominance of males (61.9%), right-handed patients (95.2%), married patients (55.5%), patients having a profession (84.1%) and patients having the 1st degree secondary education (42.9%).

Table 1. *Data related to the demographic characteristics of patients.*

		Mean ± Standard deviation	n	%
Gender				
	Male		39	61.9
	Female		24	38.1
Age		56.3 ± 13.2 years (Range: 36 and 76 years)		
Laterality				
	Right-handed		60	95.2
	Left-handed		3	0.8
Profession				
	Yes		53	84.1
	No		10	15.9
Marital status				
	Married		35	55.5
	Widow(er)		10	15.9
	Person living with a partner		10	15.9
	Single		6	9.5
	Divorced		2	3.2
Education level				
	Primary		4	6.3
	1st degree secondary		27	42.9
	2nd degree secondary		13	20.6
	Higher		19	30.2

3.1. Frequencies of Post-Stroke VCDs

Table 2 shows that among the types of post-stroke VCDs found in the 63 patients, aphasia (n = 32; 50.8%) and dysarthria (n = 27; 42.9%) were more frequent than apraxia of speech (n = 4; 6.3%). Of the 63 stroke survivors, Broca's aphasia (n = 11; 17.5%) and flaccid dysarthria (n = 16; 25.4%) were predominant.

Table 2. *Data related to the types of post-stroke verbal communication disorders.*

		n	%
Dysarthria			
	Flaccid dysarthria	16	25.4
	Hypokinetic dysarthria	7	11.1
	Hyperkinetic dysarthria	3	4.8
	Spastic dysarthria	1	1.6
Aphasia			
	Broca's aphasia	11	17.5
	Mixed transcortical aphasia	6	9.5
	Transcortical motor aphasia	4	6.3
	Wernicke's aphasia	4	6.3
	Transcortical sensory aphasia	3	4.8
	Global aphasia	3	4.8
	Conductive aphasia	1	1.6
Apraxia of speech		4	6.3

Among the 32 patients suffering from aphasia, 1 (3.1%), 18 (56.3%) and 13 (40.6%) had, respectively, mild aphasia, moderate aphasia and severe aphasia.

From the 27 patients having dysarthria, 9 (33.3%), 11 (40.8%), 3 (11.1%) and 4 (14.8%) had, respectively, mild dysarthria, moderate dysarthria, severe dysarthria and massive dysarthria.

Among the 4 patients suffering from apraxia of speech, 1 had a lower degree of severity of apraxia of speech than the other 3.

3.2. Clinical Characteristics of Patients

Table 3 shows the clinical characteristics of the 63 patients. It reveals a predominance of patients with: cerebral artery infarction (90.4%); affected left cerebral hemisphere (77.8%); involvement of the middle cerebral artery territory (90.4%); co-occurrence of motor deficiency and VCD (90.5%).

Table 3. *Data related to the clinical characteristics of patients.*

		Mean ± Standard deviation	n	%
Stroke				
	Type of stroke			
	Cerebral artery infarction		57	90.4
	Intracerebral hemorrhage		6	9.6
	Site of brain lesion			
	Left hemisphere		49	77.8
	Right hemisphere		14	22.2
	Topography of brain lesion			
	Middle cerebral artery involvement		57	90.4
	Lumbar parietal hematomas		1	1.6
	Deep hematomas			
	Capsular		2	3.2
	Capsulo-thalamo-lenticular		2	3.2
	Lenticular		1	1.6
	Size of brain lesion			
	Cerebral artery infarction	19.9 ± 5.4 mm (range: 10 and 32 mm)		
	Intracerebral hematomas	11.4 ± 2.1 ml (range: 10 and 15 ml)		
	NIHSS score	12.2 ± 5.7 (range: 1 and 32)		
	Modified Rankin score	2.7 ± 0.6 (range: 2 and 4)		
Other stroke-related disorders co-occurred with verbal communication disorder				
	Motor deficiency			
	Hemiplegia		49	77.8
	Hemiparesis		5	7.9
	Monoparesis		2	3.2
	Monoplegia		1	1.6
	Lateral homonymous hemianopsia		4	6.3
	Hemi-hypoesthesia		2	3.2

3.3. Therapeutic and Evolutive Aspects of Post-Stroke VCDs

The therapeutic characteristics of the 63 patients were as follows: average time to speech therapy = 4.6 ± 2.5 weeks (range: 1 and 10 weeks); average number of rehabilitation sessions per week = 2.5 ± 0.5 sessions (range: 2 and 3 sessions); average duration of speech therapy sessions = 45 ± 15 minutes (range: 30 and 60 minutes).

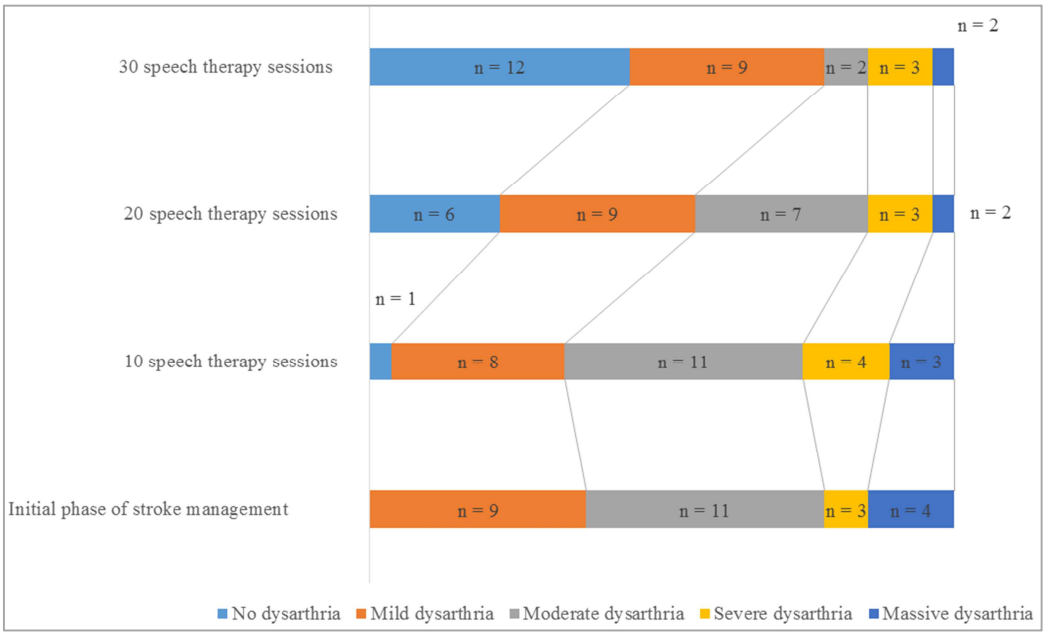

Figure 1. *Evolution of dysarthria.*

Regarding the evolution of dysarthria, Figure 1 shows that:

1) at 10 speech therapy sessions (1 month of speech therapy after stroke), of the 9 patients having mild dysarthria in the initial phase of stroke management, 1 responded positively to treatment, changing to 1 dysarthria-free patient (3.7%). The 8 (29.6%) patients having mild dysarthria observed in the "10 speech therapy sessions" phase were those who did not responded to speech therapy. The 11 (40.8%) patients having moderate dysarthria observed in the "10 speech therapy sessions" phase were those from the initial stroke management phase who did not responded to speech therapy. The 3 patients having severe dysarthria from the initial phase of stroke management did not responded to speech therapy; they are referred to as the "3 old patients having severe dysarthria". Of the 4 patients having massive dysarthria in the initial stroke management phase, 1 responded positively to speech therapy, thus changing to 1 "new patient having severe dysarthria". This and the 3 "old patients having severe dysarthria" made up the 4 (14.8%) patients having severe dysarthria observed in the "10 speech therapy sessions" phase. The 3 (11.1%) patients having massive dysarthria observed in the "10 speech therapy sessions" phase were those from the initial stroke management phase who did not responded to speech therapy;
2) at 20 speech therapy sessions (2 months of speech therapy after stroke), of the 8 patients having mild dysarthria in the "10 speech therapy sessions" phase, 5 responded positively to speech therapy, changing to 5 dysarthria-free patients, and 3 were in the same clinical state (3 "old patients having mild dysarthria "). The 5 dysarthria-free patients and the dysarthria-free patient obtained in the "10 speech therapy sessions" phase made up the 6 (22.2%) dysarthria-free patients observed in the "20 speech therapy sessions" phase. The 3 "old patients having mild dysarthria" and the 6 new patients having mild dysarthria resulting from the positive response to speech therapy of the 11 patients having moderate dysarthria in the "10 speech therapy sessions" phase, made up the 9 (33.3%) patients having mild dysarthria observed in the "20 speech therapy sessions" phase. The 5 patients having moderate dysarthria in the "10 speech therapy sessions" phase who did not respond to speech therapy and the 2 new patients having moderate dysarthria resulting from the positive response to speech therapy of the 4 patients having severe dysarthria in the "10 speech therapy sessions" phase, made up the 7 (26%) patients having moderate dysarthria observed in the "20 speech therapy sessions" phase. The other 2 patients having severe dysarthria in the "10 speech therapy sessions" phase who did not respond to speech therapy, and the new patient having severe dysarthria resulting from the positive response to speech therapy of the 3 patients having massive dysarthria in the "10 speech therapy sessions" phase, made up the 3 (11.1%) patients having severe dysarthria observed in the "20 speech therapy sessions" phase. The 2 (7.4%) patients having massive dysarthria observed in the "20 speech therapy sessions" phase were those from the "10 speech therapy sessions" phase who did not responded to speech therapy;
3) at 30 sessions of speech therapy (3 months of speech therapy after stroke), of the 9 patients having mild dysarthria in the "20 sessions of speech therapy" phase, 6 responded positively to speech therapy, changing to 6 dysarthria-free patients, and 3 were in the initial clinical state (3 " old patients having mild dysarthria "). These 6 patients and the 6 dysarthria-free patients obtained in the "20 speech therapy sessions" phase made up the 12 (44.5%) dysarthria-free patients observed in the "30 speech therapy sessions" phase. The 3 "old patients having mild dysarthria" and the 6 new patients having mild dysarthria resulting from the positive response to speech therapy of the 7 patients having moderate dysarthria in the "20 speech therapy sessions" phase, made up the 9 (33.3%) patients having mild dysarthria observed in the "30 speech therapy sessions" phase. The patient having moderate dysarthria from the "20 speech therapy sessions" phase who did not responded to treatment and the new patient having moderate dysarthria resulting from the positive response to speech therapy of the 3 patients having severe dysarthria from the "20 speech therapy sessions" phase made up the 2 (7.4%) patients having moderate dysarthria observed in the "30 speech therapy sessions" phase. The 2 patients having severe dysarthria in the "20 speech therapy sessions" phase who did not responded to treatment, and the new patient having severe dysarthria resulting from the positive response to speech therapy of the 3 patients having massive dysarthria in the "20 speech therapy sessions" phase, formed the 3 (11.1%) patients having severe dysarthria observed in the "30 speech therapy sessions" phase. The patient having massive dysarthria (3.7%), observed in the "30 speech therapy sessions" phase, was the one from the "20 speech therapy sessions" phase who did not responded to speech therapy.

With regard to the evolution of aphasia, Figure 2 shows that:

1) at 10 speech therapy sessions, and compared with data from the initial phase of stroke management, patients were in their initial clinical state;
2) at 20 speech therapy sessions, the patient having mild aphasia in the "10 speech therapy sessions" phase was still in the initial clinical state. Of the 18 patients having moderate aphasia in the "10 speech therapy sessions" phase, 6 responded positively to speech therapy, changing to 6 "new patients with mild aphasia", and 12 still had moderate aphasia (12 "old patients having moderate aphasia"). The patient having mild aphasia from the "10 speech therapy sessions" phase and the 6 "new patients having mild aphasia" made up the 7

(21.9%) patients having mild aphasia observed in the "20 speech therapy sessions" phase. The 12 "old patients having moderate aphasia" and the 8 new patients having moderate aphasia resulting from the positive response to speech therapy of the 13 patients having severe aphasia in the "10 speech therapy sessions" phase, made up the 20 (62.5%) patients having moderate aphasia observed in the "20 speech therapy sessions" phase. The 5 (15.6%) patients having severe aphasia observed in the "20 speech therapy sessions" phase were those in the "10 speech therapy sessions" phase who did not responded to speech therapy;

3) at 30 speech therapy sessions, of the 7 patients having mild aphasia in the "20 speech therapy sessions" phase, 2 responded positively to speech therapy, thus changing to 2 (6.3%) aphasia-free patients, and 5 were in the initial clinical state (5 "old patients having mild aphasia "). Of the 20 patients having moderate aphasia in the "20 speech therapy sessions" phase, 12 responded positively to speech therapy, changing to 12 "new patients having mild aphasia", and 8 were in the initial clinical state (8 "old patients having moderate aphasia"). The 5 "old patients having mild aphasia" from the "20 speech therapy sessions" phase and the 12 "new patients having mild aphasia" made up the 17 (53.1%) patients having mild aphasia observed in the "30 speech therapy sessions" phase. The 8 " old patients having moderate aphasia " and the 5 patients having moderate aphasia resulting from the positive response to speech therapy of the 5 patients having severe aphasia in the "20 speech therapy sessions" phase, made up the 13 (40.6%) patients having moderate aphasia observed in the "30 speech therapy sessions" phase.

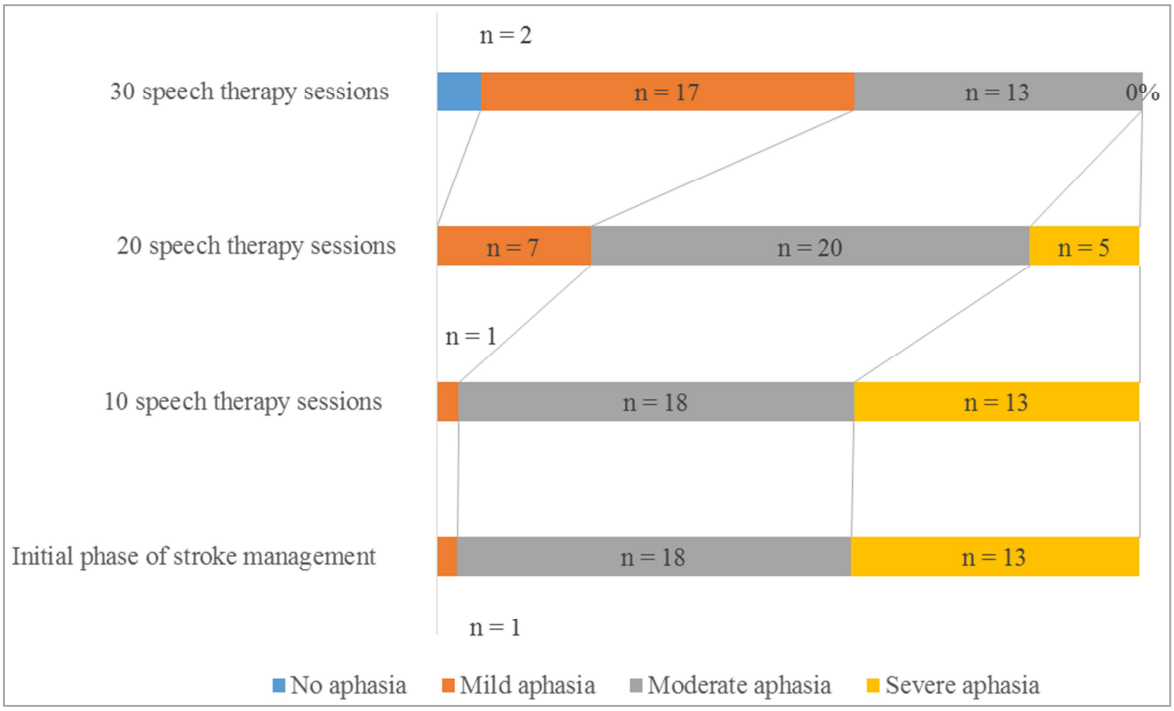

Figure 2. *Evolution of aphasia.*

Regarding to the evolution of apraxia of speech, at 10 speech therapy sessions, the patient having the lowest degree of severity of the disorder had completely recovered his speech. The other 3 patients having a higher degree of severity of the disorder remained in their initial clinical state. At 20 speech therapy sessions, no improvement in apraxia of speech was observed in these 3 patients. At 30 speech therapy sessions, they showed a small improvement in apraxia of speech.

3.4. Psychological Experience of VCDs by Patients

From a total of 63 patients, 42 (66.7%) were free of language comprehension disorders. Thus, these 42 patients were included in the study of the psychological experience of VCDs.

Based on the hospital anxiety and depression scale, 30 (71.4%) patients were diagnosed with anxiety and depression.

Using the Rosenberg self-esteem scale, we found 19 (45.2%) patients with low self-esteem, 13 (31%) patients with moderate self-esteem and 10 (23.8%) patients with high self-esteem.

Other feelings experienced by the 42 patients and investigated using the survey questionnaire included frustration (n = 38; 90.5%), anger (n = 29; 69%), bad luck (n = 15; 35.7%), overprotection (n = 15; 35.7%), divine punishment (n = 12; 28.6%) and fatality (n = 11; 26.2%).

4. Discussion

This study focuses on the frequencies of post-stroke VCDs,

their evolution following speech therapy treatment and patients' psychological experience of post-stroke VCDs.

Our overall frequency of VCDs (53.6%) is close to those reported in other studies, namely [54] (51.5%) and [55] (55.7%). It is lower than those reported in the following previous studies: [17] (42%); [27] (64%), [56] (42,1%); [57] (38%). The frequencies of aphasia, dysarthria, apraxia of speech and subtypes of the 3 types of VCDs vary from study to study [7, 17, 19, 58, 59].

In this study, the frequency of apraxia of speech (6.3%) is higher than those reported in other studies, namely [7] (2.3%) and [60] (2.4%).

In our series, the frequency of post-stroke aphasia is higher than that of post-stroke dysarthria, but no significant difference is observed between the 2 types of VCDs ($p = 0.50$). Frequencies were higher in stroke survivors having aphasia than in stroke survivors having dysarthria in research conducted by the Neurology Research Institute of the Russian Academy of the Medical Sciences (aphasia: 36%; dysarthria: 14%) [61] and by Godefroy *et al*. in 2002 (aphasia: 67.2%; dysarthria: 7.1%) [62]. On the other hand, frequencies were higher in stroke survivors having dysarthria than in stroke survivors having aphasia in the following previous studies: [15] (dysarthria: 57.69%; aphasia: 24.67%); [16] (dysarthria: 42%; aphasia: 30%); [17] (dysarthria: 26%; aphasia: 16%); [18] (dysarthria: 44%; aphasia: 23%); [27] (dysarthria: 24%; aphasia: 12%); [40] (dysarthria: 69.5%; aphasia: 45.4%); [59] (dysarthria: 49%; aphasia: 29%).

With regard to aphasia subtypes in our population of 32 stroke victims suffering from aphasia, Broca's aphasia (34.4%) is dominant, followed by mixed transcortical aphasia (18.7%). Broca's aphasia is also ranked the first among other aphasia subtypes in the following previous studies: [23] (Broca's aphasia (25.5%), followed by Wernicke's aphasia (14.8%)); [63] (Broca's aphasia (27.2%), followed by anomic aphasia (26.4%)); [64] (Broca's aphasia (68.3%), followed by Wernicke's aphasia (17%). Broca's aphasia is ranked the second among other aphasia subtypes in the following previous studies: [13] (global aphasia (32%), followed by Broca's aphasia (12%)); [15] (global aphasia (35.1%), followed by Broca's aphasia (24.7%)); [62] (global aphasia (25.1%), followed by Broca's aphasia (10.6%)); [65] (global aphasia (48.51%), followed by Broca's aphasia (23.26%)). Mixed transcortical aphasia, which occupies the second rank among the aphasia subtypes in our study, is ranked the first in the study conducted by Brust *et al*. in 1976 (mixed transcortical aphasia (60.5%), followed by Wernicke's aphasia (13.6%)) [66].

Regarding dysarthria subtypes, in our population of 27 stroke victims suffering from dysarthria, flaccid dysarthria (59.2%) is dominant, followed by hypokinetic dysarthria (25.9%). In their study, Chand-Mall and Vanaja in 2017 did not find flaccid dysarthria, but rather hypokinetic dysarthria (6.2%), which occupies the 4th rank after unilateral upper motor neuron dysarthria (50%), spastic dysarthria (31.1%) and ataxic dysarthria (12.5%) [67].

The variability in the frequencies of aphasia, dysarthria, aphasia subtypes and dysarthria subtypes observed in the various studies could be attributed to the following factors: patient selection criteria; sample size; VCD assessment methods; investigators' experience in VCD assessment; localization of brain lesion; size of brain lesion; side of cerebral hemisphere affected; stroke type [7, 21-27, 54, 58, 59, 67-71].

Table 3 shows that the frequency of VCD is higher in patients having cerebral arterial infarction, as compared with patients having intracerebral hemorrhage. This is also seen in previous studies [54, 56, 57, 59, 64, 72].

Table 3 also shows that the left side of the cerebral hemisphere is most affected in stroke victims suffering from VCD. This is consistent with the results of previous studies [16, 37, 54, 56, 59, 69, 73].

Moreover, Table 3 shows that the most damaged neuroanatomical site is the middle cerebral artery territory. This site is the main cause of VCDs in our study. This is in line with findings reported by other investigators [25, 74-76].

Studies report that the neuroanatomical site is among the factors that have an impact on the remission of post-stroke VCDs [20, 75].

Regarding the remission of dysarthria in the present series, Figure 1 shows a good gradual regression of dysarthria. Small partial regressions of mild and massive dysarthria were observed at 1 month of speech therapy after stroke. Regression of dysarthria became significant at 2 months of speech therapy after post-stroke ($p = 0.002$). Good remission of dysarthria was obtained at 3 months of speech therapy after stroke, with 44% of dysarthric patients having completely recovered speech and a significant transformation of initial severe clinical form into another less severe clinical form ($p < 0.001$). The improvement in dysarthria, observed in our study, has also been reported in other studies [40, 69]. The rate of our patients having completely recovered speech is close to that reported in the study conducted by Ali et al. in 2015 (40.9%) [40].

With regard to the remission of aphasia in this study, Figure 2 shows a slow, gradual regression of aphasia. At 1 month of speech therapy after stroke, no regression of aphasia is observed. Partial regression of aphasia began at 2 months of speech therapy after stroke, with change from initial moderate aphasia to mild aphasia on the one hand, and change from initial severe aphasia to moderate aphasia on the other hand ($p = 0.021$). A good evolution of aphasia was obtained at 3 months of speech therapy after stroke, with 6% of patients having completely recovered speech, a complete transformation of initial severe aphasia into moderate aphasia, remission of initial mild aphasia and partial regression of initial moderate aphasia ($p < 0.001$). Studies report that during the first 3 months after stroke, spontaneous recovery of speech and spontaneous transformation of an initial severe clinical form into another less severe clinical form occur in patients [13 77-79]. It therefore seems difficult to attribute our results on speech recovery and regression of the various clinical forms of aphasia solely to speech therapy [33]. Laska et al. in 2001 reported that patients with aphasia have a high potential

regression during the first 3 months after stroke [78]; and this is in agreement with our results obtained at 3 months of speech therapy. The rate of our patients having completely recovered speech is lower than that reported in the study conducted by Ali et al. in 2015 (17.9%) [40].

Regarding the remission of apraxia of speech in our series, one patient recovered speech at 1 month of speech therapy after stroke. However, it seems difficult to assert that this remission was the result of speech therapy because of the existence of spontaneous remission of apraxia [73]. The slight partial regression of apraxia of speech observed at 3 months of speech therapy in our 3 patients was also reported by Donkervoort *et al*. in 2006 [82]. Researchers report that apraxia of speech requires complex management combining music therapy, speech therapy and sometimes transcranial stimulation techniques [83, 84]. This may explain the low rate of speech recovery observed in apraxic patients.

Apraxia of speech, aphasia and dysarthria are seen as communication barriers [73, 85]. When communication is affected, psychological and social problems often follow in stroke survivors [8, 86, 87].

The results of the present study show that the dominant psychological problems experienced by patients having VCDs are frustration, depression, anxiety, anger and low self-esteem. They are consistent with those reported by other researchers [8, 86-90].

The present study has some limitations. The small sample size makes it impossible to generalize the results obtained to the study population in Congo. Ninety percent of patients have the middle cerebral artery territory affected. The small numbers of different subtypes of post-stroke VCDs did not allow us to assess, in patients with the middle cerebral artery territory affected, the impact of the degree of severity of these subtypes and the size of their brain lesion on speech recovery and VCD subtype outcome; this suggests that future research should be carried out on larger samples to analyze this problem, but also to confirm the trend in post-stroke VCD frequencies.

The strength of this research is the high rate of participants. The additional strength is that the results on the evolution of post-stroke VCDs show the way to the improvement of the therapeutic strategies used in the rehabilitation departments of the 2 hospitals to increase the degree of speech recovery.

5. Conclusion

VCDs are common in stroke survivors in Brazzaville. Among the VCDs diagnosed in our patients, aphasia and dysarthria are dominant, followed by apraxia of speech. The speech therapy technique used to treat dysarthria led to a better degree of speech recovery, as compared to speech therapy techniques related to aphasia and apraxia of speech. The rates of aphasic and apraxic patients having completely recovered speech are very low, suggesting the implementation of improved therapeutic measures to increase the degree of speech recovery. VCDs are the cause of various psychological problems in our patients. Among the psychological problems listed, frustration, anxiety, depression and anger are dominant.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

Appendix

Questionnaire on feelings experienced by patients with verbal communication disorder

I. - Do you feel frustrated since the onset of the verbal communication disorder?

Please mark [x] the appropriate answer

Yes ☐

No ☐

I do not know what to say ☐

II. - Do you feel irritated since the onset of the verbal communication disorder?

Please mark [x] the appropriate answer

Yes ☐

No ☐

I do not know what to say ☐

III. - Do you see your verbal communication disorder as divine punishment?

Please mark [x] the appropriate answer

Yes ☐

No ☐

I do not know what to say ☐

IV. - Do you consider your verbal communication disorder to be bad luck?

Please mark [x] the appropriate answer

Yes ☐

No ☐

I do not know what to say ☐

V. - Do you consider your verbal communication disorder to be inevitable?

Please mark [x] the appropriate answer

Yes ☐

No ☐

I do not know what to say ☐

VI. - Do you feel overprotected by your loved ones since the onset of your verbal communication disorder?

Please mark [x] the appropriate answer

Yes ☐

No ☐

I do not know what to say ☐

References

[1] Lajoie, C., Ferré, P. and Ska, B. (2010) L'impact de la nature des lésions sur les troubles de la communication consécutifs à une lésion cérébrale droite. *Revista Neuropsicologia Latinoamericana*, 2 (3), 12-20.

[2] Haute Autorité de Santé (2022) Rééducation à la phase chronique de l'AVC de l'adulte: pertinence, indications et modalités. http://www.has-sante.fr

[3] Wray, F., Clarke, D. and Forster, A. (2019) How do stroke survivors with communication difficulties manage life after stroke in the first year? A qualitative study. International Journal *of Language &* Communication Disorders*,* 54 (5), 814-827. doi: 10.1111/1460-6984.12487.

[4] Gil, R. (2014). Abrégés de neuropsychologie (6e éd.). Paris: Elsevier Masson.

[5] Darley, F. L., Brown, J. R. and Aronson, A. E. (1975) Motor Speech Disorders. Philadelphia PA: Saunders. doi: 10.3109/asl2.1975.3.issue-1.03.

[6] Duffy JR. (2013) Motor speech disorders: substrates, differential diagnosis, and management. Third edition. St. Louis, Missouri: Elsevier.

[7] Esmailzade Moghimi, S., Mohammadi, F., Yadegari, F., Dehghan, M., Hojjati, S. M. M., Saadat, P., Geraili, Z. and Alizadeh, M. (2021) Verbal and oral apraxia in patients with acute stroke: Frequency, relationship, and some risk factors. *Applied Neuropsychology: Adult.* doi: 10.1080/23279095.2021.1993225.

[8] Dickson, S., Barbour, R. S., Brady, M., Clark, A. M. and Paton, G. (2008) Patients' experiences of disruptions associated with post-stroke dysarthria. *International Journal of Language & Communication Disorders*, 43 (2), 135-153. doi: 10.1080/13682820701862228.

[9] Brady, C., Dickson, A. M., Paton, S. and Barbour, R. S. (2011). The impact of stroke-related dysarthria on social participation and implications for rehabilitation. *Disability and Rehabilitation*, 33 (3), 178-186. https://doi.org/10.3109/09638288.2010.517897

[10] Sinanovic, O., Mrkonjic, Z. and Zecic, S. (2012) Quality of life and post-stroke aphasic syndromes. *Periodicum Biologorum*, 114, 435–440.

[11] Koleck, M., Gana, K., Lucot, C., Darrigrand, B., Mazaux, J.-M., and Glize, B. (2017) Quality of life in aphasic patients 1 year after a first stroke. *Quality of Life Research*, 26 (1), 45–54. http://www.jstor.org/stable/44853198

[12] Bullier, B., Cassoudesalle, H., Villain, M., Cogné, M., Mollo, C., De Gabory, I., Dehail, P., Joseph, P. A., Sibon, I. and Glize, B. (2020) New factors that affect quality of life in patients with aphasia. *Annals of Physical and Rehabilitation Medicine*, 63 (1), 33-37. https://doi.org/10.1016/j.rehab.2019.06.015

[13] Pedersen, P. M., Vinter, K. and Olsen, T. S. (2004) Aphasia after stroke: type, severity and prognosis. The Copenhagen aphasia study. Cerebrovascular *Diseases*, 17 (1), 35-43. doi: 10.1159/000073896.

[14] Engelter, S. T., Gostynski, M., Papa, S., Frei, M., Born, C., Ajdacic-Gross, V., Gutzwiller, F. and Lyrer, P. A. (2006) Epidemiology of aphasia attributable to first ischemic stroke: incidence, severity, fluency, etiology, and thrombolysis. *Stroke*, 37 (6), 1379-1384. doi: 10.1161/01.STR.0000221815.64093.8c.

[15] Vidović, M., Sinanović, O., Šabaškić, L., Hatičić, A. and Brkić E. (2011) Incidence and types of speech disorders in stroke patients. *Acta Clinica Croatica*, 50 (4), 491-494.

[16] Flowers, H. L., Silver, F. L., Fang, J., Rochon, E. and Martino R. (2013) The incidence, co-occurrence and predictors of dysphagia, dysarthria and aphasia after first-ever acute ischemic stroke. Journal *of* Communication Disorders, 46 (3), 238-248. doi: 10.1016/j.jcomdis.2013.04.001.

[17] Stipancic, K. L., Borders, J. C., Brates, D. and Thibeault, S. L. (2019) Prospective Investigation of Incidence and Co-Occurrence of Dysphagia, Dysarthria, and Aphasia Following Ischemic Stroke. *American Journal of Speech-Language Pathology*, 28 (1), 188–194. doi: 10.1044/2018_AJSLP-18-0136.

[18] De Cock, E., Batens, K., Hemelsoet, D., Boon, P., Oostra, K. and De Herdt, V. (2020) Dysphagia, dysarthria and aphasia following a first acute ischaemic stroke: incidence and associated factors. European Journal *of* Neurology, 27 (10), 2014-2021. doi: 10.1111/ene.14385.

[19] Ghoreyshi, Z., Nilipour, R., Bayat, N., Nejad, S. S., Mehrpour, M. and Azimi, T. (2022) The Incidence of Aphasia, Cognitive Deficits, Apraxia, Dysarthria, and Dysphagia in Acute Post Stroke Persian Speaking Adults. Indian *Journal of Otolaryngology and* Head & Neck *Surgery*, 74 (Suppl 3), 5685-5695. doi: 10.1007/s12070-021-03006-9.

[20] Plowman, E., Hentz, B. and Ellis, C. Jr. (2012) Post-stroke aphasia prognosis: a review of patient-related and stroke-related factors. *Journal of Evaluation in Clinical Practice*, 18 (3), 689-694. doi: 10.1111/j.1365-2753.2011.01650.x.

[21] Urban, P. P., Wicht, S., Vukurevic, G., Fitzek, C., Fitzek, S., Stoeter, P., Massinger, C., Hopf, H. C. H. (2001) Dysarthria in acute ischemic stroke. Lesion topography, clinicoradiologic correlation, and etiology. *Neurology*, 56 (8), 1021-1027. doi: 10.1212/WNL.56.8.1021.

[22] Jodzio, K., Gasecki, D., Drumm, D. A., Lass, P. and Nyka, W. (2003) Neuroanatomical correlates of the post-stroke aphasias studied with cerebral blood flow SPECT scanning. *Medical Science Monitor*, 9 (3), MT32-41.

[23] Yang, Z. H., Zhao, X. Q., Wang, C. X., Chen, H. Y. and Zhang, Y. M. (2008) Neuroanatomic correlation of the post-stroke aphasias studied with imaging. Neurological Research, 30 (4), 356-360. doi: 10.1179/174313208X300332.

[24] Kang, E. K., Sohn, H. M., Han, M. K., Kim, W., Han, T. R. and Paik, N. J. (2010) Severity of post-stroke aphasia according to aphasia type and lesion location in Koreans. *Journal of Korean Medical Science*, 25 (1), 123-127. doi: 10.3346/jkms.2010.25.1.123.

[25] Khedr, E. M., Abbass, M. A., Soliman, R. K., Zaki, A. F., Gamea, A., El-Fetoh, N. A. and Abdel-Aaal, MA. (2020) A hospital-based study of post-stroke aphasia: frequency, risk factors, and topographic representation. *The Egyptian Journal of Neurology, Psychiatry and Neurosurgery*, 56, Article number: 2 (2020). https://doi.org/10.1186/s41983-019-0128-1

[26] Lee, S., Na, Y., Tae, W. S. and Pyun, S. B. (2020) Clinical and neuroimaging factors associated with aphasia severity in stroke patients: diffusion tensor imaging study. Scientific Reports, 10, 12874 (2020). doi: 10.1038/s41598-020-69741-1.

[27] Mitchell, C., Gittins, M., Tyson, S., Vail, A., Conroy, P., Paley, L. and Bowen, A. (2021) Prevalence of aphasia and dysarthria among inpatient stroke survivors: describing the population, therapy provision and outcomes on discharge. *Aphasiology*, 35 (7), 950-960. doi: 10.1080/02687038.2020.1759772.

[28] West, C., Hesketh, A., Vail, A. and Bowen A. (2005) Interventions for apraxia of speech following stroke. Cochrane Database of Systematic Reviews, 4, CD004298. doi: 10.1002/14651858.CD004298.

[29] Fridriksson, J. and Hillis, A. E. (2021) Current Approaches to the Treatment of Post-Stroke Aphasia. *Journal of Stroke*, 23 (2), 183-201. https://doi.org/10.5853/jos.2020.05015

[30] Mitchell, C., Bowen, A., Tyson, S., Butterfint, Z. and Conroy, P. (2017) Interventions for dysarthria due to stroke and other adult-acquired, non-progressive brain injury. Cochrane Database of Systematic Reviews, 1 (1), CD002088. doi: 10.1002/14651858.CD002088.

[31] Basilakos A. (2018) Contemporary Approaches to the Management of Post-stroke Apraxia of Speech. *Seminars in* Speech *and* Language, 39 (1), 25-36. doi: 10.1055/s-0037-1608853.

[32] Cichon, N., Wlodarczyk, L., Saluk-Bijak, J., Bijak, M., Redlicka, J., Gorniak, L. and Miller, E. (2021) Novel. Advances to Post-Stroke Aphasia Pharmacology and Rehabilitation. *Journal of Clinical Medicine*, 10 (17), 3778. https://doi.org/10.3390/jcm10173778

[33] Haldin, C., Lœvenbruck, H., Hueber, T., Marcon, V., Piscicelli, C., Perrier, P., Chrispin, A., Pérennou, D. and Baciu, M. (2021) Speech rehabilitation in post-stroke aphasia using visual illustration of speech articulators. A case report study. Clinical Linguistics *and Phonetics*, 35 (3), 253-276. doi: 10.1080/02699206.2020.1780473.

[34] Palmer, R. and Pauranik, A. (2021) Rehabilitation of Communication Disorders. In: Platz, T., Ed., Clinical Pathways in Stroke Rehabilitation. Evidence-based Clinical Practice Recommendations. Switzerland: Springer, 175-190. https://doi.org/10.1007/978-3-030-58505-1_10

[35] Carr, P., Moser, D., Williamson, S., Robinson, G. and Kintz, S. (2022) Improving Functional Communication Outcomes in Post-Stroke Aphasia via Telepractice: An Alternative Service Delivery Model for Underserved Populations. *International Journal of Telerehabilitation*, 14 (2), Fall 2022. https://doi.org/10.5195/ijt.2022.6531.

[36] Yang, X., Shi, L., Ran, D., Li, M., Qin, C. and An, Z. (2022) The treatment of post-stroke dysarthria with a combination of different acupuncture types and language rehabilitation training: a systematic review and network meta-analysis. *Annals of Translational Medicine*, 10 (23), 1281. doi: 10.21037/atm-22-5583.

[37] Wade, D. T., Hewer, R. L., David, R. M. and Enderby, P. M. (1986) Aphasia after stroke: natural history and associated deficits. Journal *of Neurology*, Neurosurgery & Psychiatry, 49 (1), 11-16. doi: 10.1136/jnnp.49.1.11.

[38] Pashek, G. V. and Holland, A. L. (1988) Evolution of aphasia in the first year post-onset. *Cortex*, 24, 411-423. doi: 10.1016/s0010-9452(88)80004-2.

[39] El Hachioui, H., Van de Sandt-Koenderman, M., Dippel, D., Koudstaal, P. and Visch-Brink, E. (2011). A 3-year evolution of linguistic disorders in aphasia after stroke. *International Journal of Rehabilitation Research*, 34 (3), 215-221. doi: 10.1097/MRR.0b013e3283460e65.

[40] Ali, M., Lyden, P., Brady, M. and VISTA Collaboration. (2015) Aphasia and Dysarthria in Acute Stroke: Recovery and Functional Outcome. *International Journal of Stroke*, 10 (3), 400-406. doi: 10.1111/ijs.12067.

[41] Gerstenecker, A. and Lazar, R. M. (2019) Language recovery following stroke. *The Clinical Neuropsychologist*, 33 (5), 928-947. doi: 10.1080/13854046.2018.1562093.

[42] Osa, G. A., Brambati, S. M., Brisebois, A., Désilets-Barnabé, M., Houzé, B., Bedetti, C., Rochon, E., Leonard, C., Desautels, A. and Marcotte, K. (2020) Predicting Early Post-stroke Aphasia Outcome From Initial Aphasia Severity. *Frontiers in Neurology*, 11, 120. doi: 10.3389/fneur.2020.00120.

[43] Billot, A., Lai, S., Varkanitsa, M., Braun, E. J., Rapp, B., Parrish, T. B., Higgins, J., Kurani, A. S., Caplan, D., Thompson, C. K., Ishwar, P., Betke, M. and Kiran, S. (2022) Multimodal Neural and Behavioral Data Predict Response to Rehabilitation in Chronic Poststroke Aphasia. *Stroke*, 53 (5), 1606-1614. doi: 10.1161/STROKEAHA.121.036749.

[44] Stefaniak, J. D., Geranmayeh, F. and Lambon Ralph, M. A. (2022) The multidimensional nature of aphasia recovery post-stroke, Brain, 145 (4), 1354-1367. doi: 10.1093/brain/awab377.

[45] Ossou-Nguiet, P. M., Gnonlonfoun, D., Bandzouzi-Ndamba, B., Mouanga, A. M., Assogba, K. and Matali, E. (2012) Qualité de vie des aphasiques post-AVC à Brazzaville. *African Journal of Neurological Sciences*, 31 (1), 34-40.

[46] Goodglass, H., Kaplan, E. and Barresi, B. (2000) Assessment of aphasia and related disorders-Third edition. Philadelphia: Lippincott Williams & Wilkins.

[47] Auzou, P. and Rolland-Monnoury, V. (2019). BECD-Batterie d'Evaluation Clinique de la Dysarthrie. Isbergues: Ortho Editions.

[48] Jonkers, R., Feiken, J., and Stuive, I. (2017). Diagnosing Apraxia of Speech on the Basis of Eight Distinctive Signs. Canadian Journal of Speech-Language Pathology and Audiology, 41 (3), 303-319.

[49] Zigmond, A. S., & Snaith, R. P. (1983). Hospital Anxiety and Depression Scale. Acta Psychiatrica Scandinavica, 67 (6), 361-370. doi: 10.1111/j.1600-0447.1983.tb09716.x.

[50] Rosenberg, M. (1986) Conceiving the Self. Krieger Publ, Malabar (Fla.).

[51] Rousseau, T., Auzou P., Rolland, V., Lambert, J., Chokron, S., Joyeux, N., Aubin, G., Allain, P and Eyoum, I. (2004). Les approches thérapeutiques en orthophonie. Tome 4 - Prise en charge orthophonique d'origine neurologique. Ortho Editions, Isbergues.

[52] González-Fernández, M., Brodsky, M. B. and Palmer, J. B. (2015) Poststroke Communication Disorders and Dysphagia. Physical Medicine and Rehabilitation Clinics of North America, 26 (4), 657-670. doi: 10.1016/j.pmr.2015.06.005.

[53] Ballard, K. J., Wambaugh, J. L., Duffy, J. R., Layfield, C., Maas, E., Mauszycki, S. and McNeil, M. R. (2015) Treatment for Acquired Apraxia of Speech: A Systematic Review of Intervention Research between 2004 and 2012. *American Journal of Speech-Language Pathology*, 24 (2), 316-337. doi: 10.1044/2015_AJSLP-14-0118.

[54] Kim, G., Min, D., Lee, E.-0., Eun Kyoung Kang, E. K. (2016) Impact of Co-occurring Dysarthria and Aphasia on Functional Recovery in Post-stroke Patients. *Annals of Rehabilitation Medicine*, 40 (6), 1010-1017. doi: 10.5535/arm.2016.40.6.1010.

[55] de Goulart, B. N. G., de Almeida, C. P. G., da Silva, M. W., Oenning, N. S. X. and Verlaine Balzan Lagni, V. B. (2016) Characterization of stroke with a focus on oral communication disorders in inpatients of a regional hospital. *Audiology Communication Research*, 21, e1603. doi: 10.1590/2317-6431-2015-1603.

[56] Kpadonou, G. T., Alagnidé, E., Niama-Natta, D., Houngbédji, G. and Adjaka, N. (2013) Verbal communication disorders in brain damaged post-stroke patients in Benin. *Annals of Physical and Rehabilitation Medicin*e, 56 (9-10), 663-672. doi: 10.1016/j.rehab.2013.08.004.

[57] Arauz, A., Rodríguez-Agudelo, Y., Sosa, A. L., Chávez, M., Paz, F., González, M., Coral, J., Díaz-Olavarrieta, C. and Román, G. C. (2014) Vascular cognitive disorders and depression after first-ever stroke: the Fogarty-Mexico Stroke Cohort. *Cerebrovascular Diseases*, 38 (4), 284-289. doi: 10.1159/000366471.

[58] Mackenzie, C. (2011) Dysarthria in stroke: A narrative review of its description and the outcome of intervention. *International Journal of Speech-Language Pathology*, 13 (2), 125-136. doi: 10.3109/17549507.2011.524940.

[59] Araki, K., Hirano, Y., Kozono, M., Fujitani, J. and Shimizu, E. (2022) The Screening Test for Aphasia and Dysarthria (STAD) for Patients with Neurological Communicative Disorders: A Large-Scale, Multicenter Validation Study in Japan. Folia *phoniatrica et logopaedica*, 74 (3), 195-208. doi: 10.1159/000519381.

[60] Weiss, P., Ubben, S., Kaesberg, S., Kalbe, E., Kessler, J., Liebig, T. and Fink, G. (2016) Where language meets meaningful action: a combined behaviour and lesion analysis of aphasia and apraxia. Brain Structure *and* Function, 221 (1), 563–576. http, 221i.org/10.1007/s00429-014-0925-3

[61] Koberskaya, N. N. (2018) Treatment of the post-stroke speech disorders in the patients with cardiac and cerebrovascular pathology. *Journal of Neurology & Stroke*, 8 (3), 155–161. doi: 10.15406/jnsk.2018.08.00301.

[62] Godefroy, O., Dubois, C., Debachy, B., Leclerc, M., Kreisler, A. and Lille Stroke Program. (2002) Vascular aphasias: main characteristics of patients hospitalized in acute stroke units. *Stroke*, 33 (3), 702-705. doi: 10.1161/hs0302.103653.

[63] Hoffmann, M and Chen, R. (2013) The spectrum of aphasia subtypes and etiology in subacute stroke. Journal *of* Stroke *&* Cerebrovascular Diseases, 22 (8), 1385-1392. doi: 10.1016/j.jstrokecerebrovasdis.2013.04.017.

[64] Gnonlonfoun, D., Adjien, C., Ossou-Nguiet, P. M., Mapoure, Y., Sissoko, A., Wouton, G., Kpadonou, T., Houinato, D. and Avode, D. G. (2017) Facteurs associés à la qualité de vie des aphasiques post accident vasculaire cérébral en milieu hospitalier à Cotonou, Benin. *Mali Médical*, 32 (2), 27-34.

[65] Brkić, E., Sinanović, O., Vidović, M., Smajlović, D. (2009) Ucestalost i klinicka fenomenologija afazickih poremećaja nakon mozdanog udara [Incidence and clinical phenomenology of aphasic disorders after stroke]. Medical *Archives*, 63 (4), 197-199.

[66] Brust, J. C., Shafer, S. Q., Richter, R. W. and Bruun, B. (1976) Aphasia in acute stroke. *Stroke*, 7 (2), 167-174. doi: 10.1161/01.str.7.2.167.

[67] Chand-Mall, R. and Vanaja, C. S. (2017). Speech Profile of Individuals with Dysarthria Following First Ever Stroke. *International Journal of Medical Research & Health Sciences*, 6 (9), 86-95.

[68] Berthier, M. L. (2005) Poststroke aphasia: epidemiology, pathophysiology and treatment. *Drugs Aging*, 22 (2), 163-182. doi: 10.2165/00002512-200522020-00006.

[69] Urban, P. P., Rolke, R., Wicht, S., Keilmann, A., Stoeter, P., Hopf, H. C. and Dieterich, M. (2006) Left-hemispheric dominance for articulation: a prospective study on acute ischaemic dysarthria at different localizations. *Brain*, 129 (Pt 3), 767-777. doi: 10.1093/brain/awh708.

[70] Fonville, S., van der Worp, H. B., Maat, P., Aldenhoven, M., Algra, A. and van Gijn, J. (2008) Accuracy and inter-observer variation in the classification of dysarthria from speech recordings. Journal *of* Neurology, 255 (10), 1545-1548. doi: 10.1007/s00415-008-0978-4.

[71] Van der Graaff, M., Kuiper, T., Zwinderman, A., Van de Warrenburg, B., Poels, P., Offeringa, A., Van der Kooi, A., Speelman, H. and De Visser, M. (2009) Clinical identification of dysarthria types among neurologists, residents in neurology and speech therapists. *European Neurology*, 61 (5), 295-300. doi: 10.1159/000206855.

[72] Sène Diouf, F., Mapoure, Y., Ndiaye, M., Touré, K., Diagne, N. S., Thiam, A., Diop, A. G., Ndiaye, M. M. and Ndiaye, I. P. (2008) Aphasies vasculaires: aspects cliniques, epidemiologiques et evolutifs [Vascular aphasias: clinical, epidemiologicaland evolutionary aspects]. *Dakar Medical*, 53 (1), 68-75.

[73] Lemmetyinen, S., Hokkanen, L. and Klippi, A. (2020). Long-term recovery from apraxia and its relation to severe apraxic-aphasic disorder in left hemisphere stroke - a systematic review. *Aphasiology*, 34 (6), 735-756. doi: 10.1080/02687038.2019.1636932.

[74] Kumral, E., Celebisoy, M., Celebisoy, N., Canbaz, D. H. and Calli, C. (2007) Dysarthria due to supratentorial and infratentorial ischemic stroke: a diffusion-weighted imaging study. *Cerebrovascular Diseases*, 23 (5-6), 331-338. doi: 10.1159/000099131.

[75] Canbaz, D. H., Celebisoy, M., Ozdemirkiran, T. and Tokucoglu, F. (2019) Dysarthria in Acute Ischemic Stroke: Localization and Prognosis. *Journal of Neurological Sciences*, 27 (1), 22, 020-027. http://www.jns.dergisi.org/text.php3?id=334

[76] Latarnik, S., Stahl, J., Vossel, S., Grefkes, C., Fink, G. R. and Weiss, P. H. (2022) The impact of apraxia and neglect on early rehabilitation outcome after stroke. *Neurology Research and Practice*, 4, Article number: 46 (2022). doi: 10.1186/s42466-022-00211-x.

[77] Demeurisse, G., Demol, O., Derouck, M., de Beuckelaer, R., Coekaerts, M. J. and Capon, A. (1980) Quantitative study of the rate of recovery from aphasia due to ischemic stroke. *Stroke*, 11 (5), 455-458. doi: 10.1161/01.str.11.5.455.

[78] Laska, A. C., Hellblom, A., Murray, V., Kahan, T. and Von Arbin, M. (2001) Aphasia in acute stroke and relation to outcome. Journal *of* Internal Medicine, 249 (5), 413-22. doi: 10.1046/j.1365-2796.2001.00812.x.

[79] Sinanović, O., Mrkonjić, Z., Zukić, S., Vidović, M. and Imamović, K. (2011) Post-stroke language disorders. Acta Clinica Croatica, 50 (1), 79-94.

[80] Robey RR. (1998) A meta-analysis of clinical outcomes in the treatment of aphasia. Journal *of* Speech, Language, *and* Hearing Research, 41 (1), 172–187. doi: 10.1044/jslhr.4101.172.

[81] Lazar, R. M., Minzer, B., Antoniello, D., Festa, J. R., Krakauer, J. W. and Marshall, R. S. (2010) Improvement in aphasia scores after stroke is well predicted by initial severity. *Stroke*, 41 (7), 1485-1488. doi: 10.1161/STROKEAHA.109.577338.

[82] Donkervoort, M., Dekker, J., Deelman, B. (2006) The course of apraxia and ADL functioning in left hemisphere stroke patients treated in rehabilitation centres and nursing homes. Clinical Rehabilitation, 20 (12), 1085-1093. doi: 10.1177/0269215506071257.

[83] Katz, W. F., McNeil, M. R. and Garst, D. M. (2010) Treating apraxia of speech (AOS) with EMA-supplied visual augmented feedback. *Aphasiology*, 24 (6), 826-837. doi: 10.1080/02687030903518176.

[84] Hurkmans, J., Jonkers, R., de Bruijn, M., Boonstra, A. M., Hartman, P. P., Arendzen, H. and Reinders-Messelink, H. A. (2015) The effectiveness of Speech–Music Therapy for Aphasia (SMTA) in five speakers with Apraxia of Speech and aphasia. *Aphasiology*, 29 (8), 939-964. doi: 10.1080/02687038.2015.1006565.

[85] Mackenzie, C., Kelly, S., Paton, G., Brady, M. and Muir, M. (2013) The Living with Dysarthria group for post-stroke dysarthria: the participant voice. *International journal of language & communication disorders*, 48 (4), 402-420. doi: 10.1111/1460-6984.12017.

[86] Parr, S. (2004) Living with severe aphasia: The experiences of communication impairment after stroke. Brighton: Pavilion Publishing.

[87] Wray, F. and Clarke, D. (2017) Longer-term needs of stroke survivors with communication difficulties living in the community: a systematic review and thematic synthesis of qualitative studies. *BMJ Open*, 7 (10), e017944. doi: 10.1136/bmjopen-2017-017944.

[88] Hilari, K., Needle, J. J. & Harrison, K. L. (2012). What are the important factors inhealth-related quality of life for people with aphasia? A systematic review. *Archives of Physical Medicine and Rehabilitation*, 93 (1 Suppl), S86-S95. doi: 10.1016/j.apmr.2011.05.028.

[89] Shehata, G. A., El Mistikawi, T., Al Sayed, K. R. and Hassan, H. S. (2015) The effect of aphasia upon personality traits, depression and anxiety among stroke patients. *Journal of affective disorders*, 172, 312-314. https://doi.org/10.1016/j.jad.2014.10.027

[90] Vuković, M. (2018) Communication Related Quality of Life in Patients with Different Types of Aphasia Following a Stroke: Preliminary Insights. *International Archives of Communication Disorder*, 1 (1), 1: 004. doi.org/10.23937/iacod-2017/1710004