Linguistic profiling and recovery pattern in Subcortical Aphasia- A single longitudinal case study.

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Submission date: 26-Jun-2020 01:10PM (UTC+0530)
Submission ID: 1349907353
File name: 1192-Article_Text-1707-1-2-20200623.docx (98.11K)
Word count: 1945
Character count: 11115

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Abstract:

Background: Aphasia is a language disorder due to damage in the specific areas of the brain, either of the two hemispheres in the brain when gets damaged due to multiple reasons such as vascular disorders: Cerebrovascular accident (Ischemic or Hemorrhage), Brain damage, tumors, Traumatic Brain Injury, and other brain disorders. Subcortical Aphasia refers to language disorder associated with the damage to specific brain structures, such as Basal ganglia, Thalamus, or the white matter pathways in general proximity to these structures. The Subcortical Aphasia diagnosis is defined by the lesion localization rather by the characteristics of the type of Aphasia.

Objectives: The main objective of this study was to report the recovery pattern seen in a patient with subcortical aphasia, and to assess the Global type of subcortical aphasia evolving to Broca's type subcortical aphasia.

Methods: This is a longitudinal study, wherein the participant with history of CVA was linguistically profiled to check for the speech, language and swallowing skills, using a test battery approach to determine the type and severity of aphasia across Evaluation 1 (E2) and Evaluation 2 (E2). The results of E1 and E2 were compared to analyze the recovery pattern in the participant with no formal clinical rehabilitation.

Results: The participant showed improvement in dysarthric features; along with type of aphasia evolving from Global type to Broca's type. This recovery pattern could be because of the spontaneous home stimulation and patient's motivation.

Conclusions: Subcortical Aphasia should be diagnosed by correlating the imagining studies along with the aphasic characteristics. Spontaneous recovery pattern is observed in this participant without formal clinical rehabilitation.

Key words:

Subcortical Aphasia, Dysarthria, Recovery, Broca's Aphasia, Global Aphasia

Introduction:

Aphasia is a language disorder due to damage in the specific areas of the brain, either of the two hemispheres in the brain when gets damaged due to multiple reasons such as vascular disorders: Cerebrovascular accident (Ischemic or Hemorrhage), Brain damage, tumors, Traumatic Brain Injury, and other brain disorders that can affect the specific skills performed by that area in the hemisphere, leading to deficits in performing the regular activities like conversation and motor tasks. In most of the people the language skills are controlled by the left hemisphere of the brain, hence damage in the left hemisphere may lead to problems in speech and language. However, damage in the right hemisphere may cause other issues, like poor attention or memory. Consequently, damage in the anterior part of the brain results in language production impairments (apparently Broca's type Aphasia),[1] while posterior pathology is associated with language understanding difficulties and disturbances in the phonological, lexical and semantic language systems (often Wernicke's type Aphasia).[2] From the past five decades, there has been a debate on a type of Aphasia called the Subcortical Aphasia. Subcortical Aphasia refers to language disorder associated with the damage to specific brain structures, such as Basal ganglia, Thalamus, or the white matter pathways in general proximity to these structures.[3] Lesions in the White Matter and the subcortical regions that do not affect the cortical regions may also result in various aphasic symptoms.[4] The Subcortical Aphasia diagnosis is defined by the lesion

localization rather by the characteristics of the type of Aphasia. Although traditionally Aphasia reflects the dysfunction in the cortical regions for language, lesions in the Subcortical Region can disrupt connections to the language cortex.

Methods:

Participant:

A 49 year old male with a medical history of Cerebrovascular accident (CVA) at the age of 45 years in the left hemisphere participated in the longitudinal study. The participant was right handed and bilingual speaker with Kannada as first language and English as second language and was journalist and a writer. Participant was under medications for post stroke recovery and was referred to a speech language pathologist by a neurosurgeon for speech and language evaluation. Magnetic Resonance Imaging (MRI) reports revealed acute infarcts in the Basal Ganglia, Insular cortex, and frontal cortex with midline shift to right hemisphere, *see Figure 1*, with abnormal Electroencephalography (EEG) findings. Further, he was a regular smoker and alcohol consumer and had family history of stroke wherein his grandfather and paternal uncle had stroke at the age of 60 and 56 years respectively.

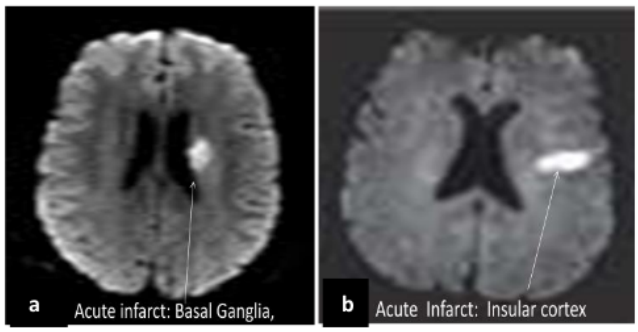

Figure 1: (a) Axial FLAIR MRI Brain showing altered signal intensity in Basal Ganglia, (b) Axial FLAIR MRI showing altered signal intensities in insular cortex

Materials and Procedure:

The Aphasia type was assessed using the Western Aphasia Battery (WAB)-Kannada version[5] by a qualified speech language pathologist. The Kannada version of WAB included specific components of oral and language subtests: spontaneous speech, auditory verbal comprehension, repetition, naming, reading, writing, Apraxia and construction, visuospatial and calculation tasks. Based on the score of subtests, Aphasia Quotient (AQ) and Cortical Quotient (CQ), the type and severity of Aphasia was evaluated.

Additionally, the participant showed dysarthric features, hence Franchay Dysarthria Assessment (FDA)[6] was administered, followed by cranial nerve examination (related to speech and hearing), further to assess the articulation, the Kannada Articulation Test[7] followed by administration of Perceptual Speech intelligibility rating scale.[8]

Lastly, to assess the overall prognosis and recovery in the daily lifestyle, the Stroke Specific Quality of Life Scale[9] was administered. Present study evaluated the recovery and prognosis of the participant by comparing the results of the first evaluation (E1) with results of second evaluation (E2). The number of post CVA days before E1 was 476 days and before E2 was 1568 days.

Results and Discussion:

E1 test results for FDA revealed spastic type of dysarthria [Figure 2], where as no problem in swallowing solids, semi-solids and liquids. The test for language assessment WAB results revealed Global type Aphasia [Table 1],[10] the speech was intelligible with effort only when context is known with a score of 5 on speech intelligibility rating scale.

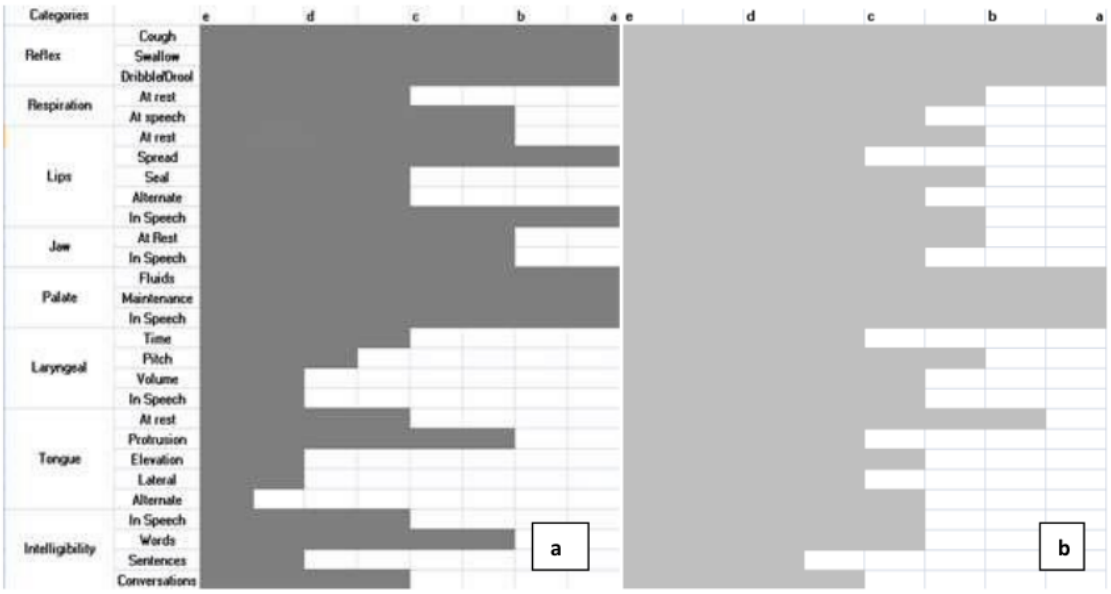

Figure 2: (a) Franchay Dysarthria Assessment Score sheet for Evaluation 1 (E1) and (b) Evaluation 2 (E2)

Table 1: Performance of the participant during E1 and E2 across the subtests of Kannada version of Western Aphasia Battery (WAB-Kannada)

	E1			E2		
Categories	**Score**	**AQ**	**CQ**	**Score**	**AQ**	**CQ**
Spontaneous speech	**9**			**10**		
Comprehension	**76**	**3.8**	**7.6**	**157**	**7.85**	**15.7**
Repetition	**26**	**1.3**	**2.6**	**30**	**1.5**	**3**
Naming	**50**	**2.5**	**5.0**	**58**	**2.9**	**5.8**
Reading and Writing	**76**	**3.8**	**7.6**	**114**	**5.7**	**11.4**
Praxis	**34**	**1.7**	**3.4**	**57**	**2.85**	**5.7**
Construction	**18**	**0.9**	**1.8**	**22**	**1.1**	**2.2**

***E1: Evaluation 1, E2: Evaluation 2, AQ: Aphasia Quotient, CQ: Cortical Quotient**

† Note: The AQ and CQ showed better results for E2 compared to E1

E2 test results for FDA showed dysarthria features but not of a specific type. However, improvement in the motor activities was seen in the oral structures [Figure 2]. The results for WAB showed Broca's type Aphasia but the MRI reports revealed acute and subacute infarctions in the Basal Ganglia, Insular Cortex and Frontal Cortex on the left hemisphere [Figure 1]. Few dysfluencies like repetitions and blocks were also seen in the phrase level. Further, to check the articulatory errors, KAT was administered which revealed few articulatory errors (Distortions>omissions>substitutions>Additions, with misarticulations in (/s/,/k/,/r/,/ch/,/j/,/y/) which were not frequent and were corrected during repetition. The Cranial Nerve Examination (speech, language and hearing related) revealed good functioning of Trigeminal nerve, Vestibulocochlear nerve, Glossopharyngeal nerve, Vagus Nerve. In contrast, the cranial nerves originating from the left hemisphere such as the Left Facial Nerve, Left Accessory Nerve and Left Hypoglossal Nerve function was affected causing asymmetric movement on the right side of

the body [Figure 3]. The overall speech intelligibility during E2 was improved compared to E1 wherein the speech can be understood with concentration by a sympathetic listener but requires 2-3 repetitions, with intelligibility score of 4. Hence based on the localization of the site of lesion with language impairments and dysarthric features the participant was provisionally diagnosed with Subcortical Aphasia.

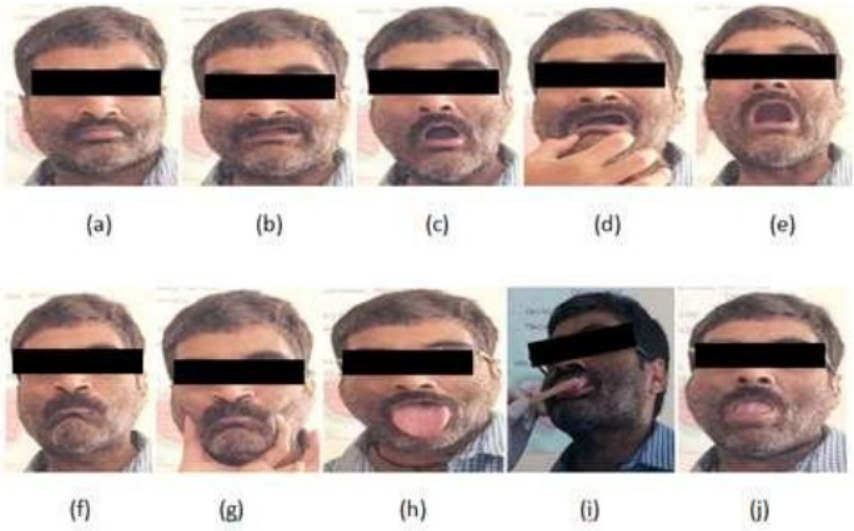

Figure 3: Examination of speech mechanism during non-speech activities- (a) at rest, (b) spontaneous smiling, Figure (c) lip rounding, (d) lip retraction against pressure, (e) mouth opening, (f) cheek puffing, (g) cheek puffing against pressure, (h) tongue protrusion, (i) tongue strength against pressure, (j) tongue lateralization to cheek

Table 2 Performance of the participant during E1 and E2 across the subtests of Stroke Specific Quality of Life (SS-QOL)

Categories	E1 Score	E2 Score
Energy	7	5
Family Roles	5	6
Language	5	5
Mobility	11	20
Mood	11	11
Personality	6	6
Self care	8	20
Social roles	10	10
Thinking	4	7
Upper Extremity Function	12	15
Vision	8	9
Work/Productivity	7	7
Total	94	121

***E1: Evaluation 1, E2: Evaluation 2**

† Note: The participant showed better results in all categories of quality of life in E2 compared to E1

Additionally, to assess the overall lifestyle of the participant the Stroke Specific Quality of Life Scale (SS QOL)[9] was administered during both the E1 and E2. The participant showed overall development in the energy, mobility, family roles, self care, thinking, upper extremity function, where as there was no improvement observed in the language domain [Table 2]. The patient has acquired the skill of writing with the left hand after 4 years post CVA [Figure 4], as this could reflect the ongoing compensatory plasticity and spontaneous recovery of patients with Broca's type- Subcortical Aphasia. Home stimulation and participant's motivation could be the reason for this recovery pattern without the formal clinical rehabilitation.

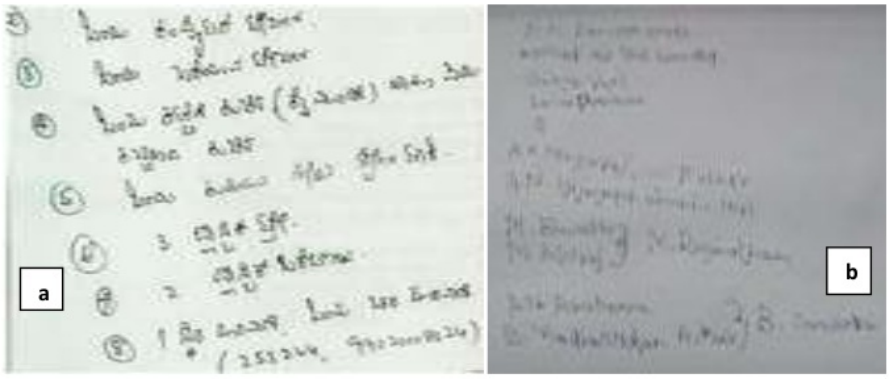

Figure 4: Participant's performance on spontaneous writing tasks. (a) Right handed spontaneous writing in Kannada (first language) pre stroke, (b) Left handed spontaneous writing in English (second language) post stroke. The participant was able to write in English post stroke during Evaluation 2 (E2) but not in Kannada.

Conclusions:

The present study was carried out on a post CVA participant with left side hemiparesis, to study the type and severity of Aphasia which is caused by the lesions in the subcortical areas such Basal Ganglia, Insular Cortex and Frontal Cortex. As the lesions were observed only in the left (dominant) hemisphere, the effects were seen on language expression giving the Aphasic features, however the lesions in the Basal Ganglia reflects the Dysarthric components in speech and motor movements in the participant. Although the participant did not undergo rehabilitation clinically, there was spontaneous recovery seen in the dysarthric features and also recovery in the type of aphasia from E1 to E2. However, this study does not address the lesion specific characteristics, future studies can focus on analyzing the recovery patterns in subcortical aphasic patients.

Financial support and sponsorship:

Nil

Conflicts of interest:

There were no conflicts of interest.

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