Clinical and Imagiological Findings After Intensive Speech Therapy on Post Stroke Aphasia: A Case Report

Achados Clínicos e Imaginológicos Após Fonoaudiologia Intensiva em Afasia Pós-AVC: Relato de Caso

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Abstract

A 45-year-old female patient suffered from a stroke due to a left middle cerebral artery dissecting aneurysm, resulting in persistent expressive aphasia. Due to minor clinical response after 1 year of rehabilitation, a patient-center clinical evaluation and a tailored and intensive program were performed. Significant improvements were reported on cognitive, language and functional scales. Functional magnetic resonance also depicted a global increase in cortical activation, namely on language areas. Despite available evidence displaying that most neurological recovery occurs within the first 6–9 months after stroke, this case exemplifies that additional recovery might occur in later stages, pending on intensive and individualized treatments. Also, we highlight that the number of activations on functional magnetic resonance imaging (fMRI) is, by itself, debatable as a surrogate for neurological recovery. Nevertheless, its' relationship with clinical improvement is valuable information.

Keywords: *Aphasia; Magnetic Resonance Imaging; Recovery Function; Stroke/complications.*

Resumo

Doente do sexo feminino, 45 anos, sofreu um acidente vascular cerebral no contexto de um aneurisma dissecante da artéria cerebral média esquerda, o qual resultou numa afasia de expressão persistente. Devido a uma resposta clínica mínima após 1 ano de tratamento de reabilitação, realizou-se uma avaliação e orientação terapêutica dirigida e intensiva, baseada nos défices específicos da doente. Foram reportadas melhorias significativas nas escalas cognitivas, de linguagem e funcionais aplicadas. Adicionalmente, também em imagens de ressonância magnética funcional foi documentado um aumento global na ativação cortical, especificamente nas áreas da linguagem. Apesar da evidência demonstrar que a maioria da recuperação neurológica ocorre nos primeiros 6-9 meses após lesão vascular cerebral, este caso exemplifica que uma recuperação adicional pode ocorrer mais tardiamente, dependendo de um tratamento intensivo e individualizado. Adicionalmente, realçamos que o número de ativações na ressonância magnética funcional é, por si só, duvidoso como *outcome* surrogado da recuperação neurológica; contudo, estas alterações em paralelo com a melhoria clínica são uma informação a valorizar.

Palavras-chave: Acidente Vascular Cerebral/complicações; Afasia; Recuperação de Função; Ressonância Magnética.

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Introduction

Stroke is a significant cause of morbidity and mortality, potentially leading to a myriad of deficits: motor, sensitive, cognitive and communicative. Up to 40% of stroke survivors might have deficits in one or more domains of the language.[1,2] Emerging evidence regarding the role of speech therapy interventions on the recovery of post stroke aphasia suggests significant improvements both at short and long-term. Also, it is thought that high intensity, high dose and long duration therapies may result in more favorable outcomes.[2]

Traditionally, clinical characterization of aphasia subtype, severity and progression relied mainly on the use of clinical rating instruments. Functional magnetic resonance imaging (fMRI) has been widely used to study the neural underpinnings of sensorimotor and neurocognitive functions in the human brain, with raising data regarding its' impact on the assessment of post stroke aphasia.[3]

We report a clinical case of a persistent expressive aphasia 1 year after a hemorrhagic stroke, and its clinical response and cortical neuronal adaptations (assessed through fMRI) after an intensive and tailored rehabilitation program. This care report was written in accordance with the CARE Guidelines.

Case Report

A previously healthy 45-year-old woman, right-handed, was admitted to an emergency department hours after an ictus of headache, vomiting, vertigo, dysarthria and gait unsteadiness. Computed tomography showed extensive left fronto-temporal cortico-subcortical hemorrhage and the angiographic study identified a left middle cerebral artery dissecting aneurysm. Microsurgical clipping was performed, followed by recovery of neurological deficits, except for expressive aphasia, so the patient engaged on a twice-weekly outpatient speech-therapy intervention.

After one year, only a marginal response was achieved, and significant impairment of expression persisted, so the patient was referred to a tertiary-care center outpatient consult for evaluation of the language deficits interfering with social interaction and precluding resumption of work.

On baseline cognitive and language assessment, the patient presented the following scores: Montreal Cognitive Assessment (MoCA) 19/30, *Bedside de Lenguaje* 19/25 and Functional Independence Measure (FIM) 118/126. Functional Magnetic Resonance Imaging (fMRI), performed 4 weeks before the treatment started, displayed scarce bilateral activations in locations corresponding to Broca and Wernicke areas, with slight right predominance on the former (Fig. 1A).

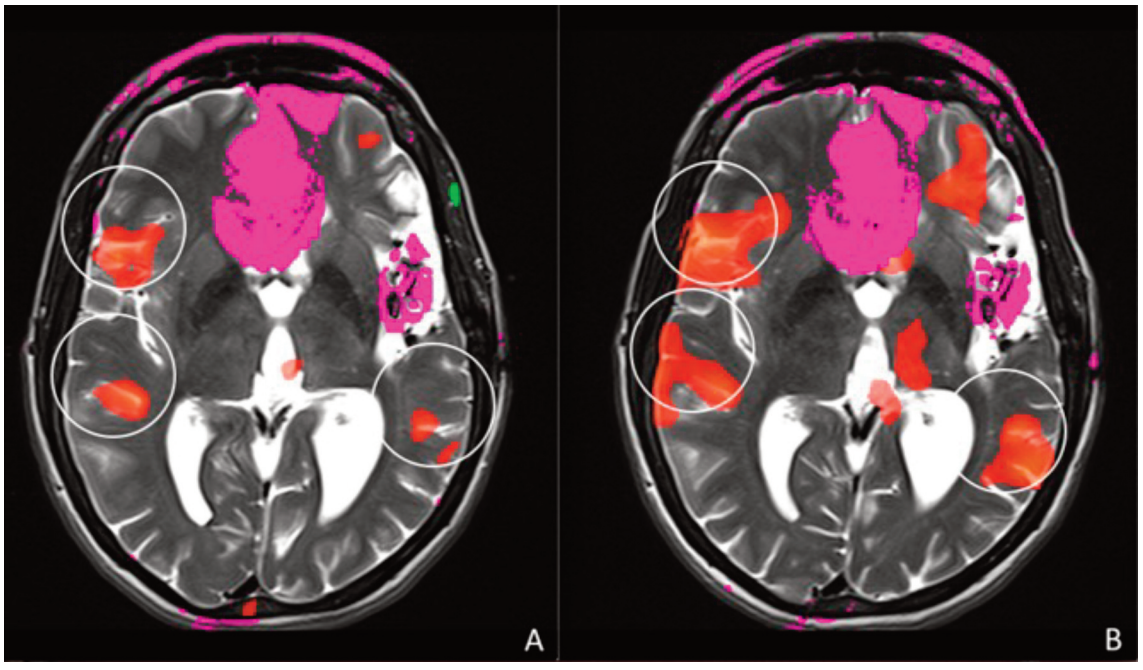

Figure 1 - A) fMRI before the treatment. B) fMRI at the follow-up evaluation. Language areas are highlighted in circles.

We started a tailored and intensive speech therapy intervention: two-hour treatment sessions per day (one hour supervised by a speech-therapist consisting on melodic intonation therapy, gestural facilitation of naming, semantic feature cuing and word retrieval strategies, and the other home-based with specific challenging exercises), 5 days/week, during 12 weeks. We assessed adherence to home program using a diary log. Clinical reevaluation and program adjustments were performed every four weeks.

Immediately after concluding the program, there was an increase of 37% (11 points) on MoCA (Minimum Clinically Important Difference (MCID): 2 points[4]), of 24% (6 points) on *Bedside de Lenguaje* and 5 points rise on FIM (MCID: 3 points[5]). Reassessment by fMRI, 1 week after the program conclusion, also depicted a global increase in cortical activation, maintaining bilateral activation, with slight right predominance in the region corresponding to Broca's area (Fig. 1B).

All achievements were sustained on follow-up evaluations (2- and 6-months past).

Discussion

Aphasia greatly impacts post-stroke patients' functionality, autonomy, participation and quality of life. Its' recovery is a complex process requiring neural repair and reorganization, through a stimulus-dependent plasticity.[6,7]

In this case, we developed a tailored rehabilitation program directed to specific language deficits and monitored both clinical and neuroimaging response to intervention.

Our patient was a young, previously healthy person with an active and cognitively demanding profession, which may have been favorable indicators of the motivation and probability of compliance of the program, and of a greater neuroplasticity.

At baseline evaluation, one year after stroke, the patient had persistent severe difficulties regarding expression. By that time, bilateral cortical activations in locations corresponding to Broca and Wernicke areas, assessed by fMRI, confirmed the existence of viable cortex engaged on the language tasks (Fig. 1A). These findings could be explained by the fact that unilateral lesions can lead to cortical disinhibition in at least two regions: 1) neighboring ipsilesional cortical areas and 2) contralesional homotopic areas connected via the corpus callosum.[8] Although its' significance is debatable, namely whether it is due to adaptative neuroplasticity or just biology variance, it might support the beneficial effect of rehabilitation strategies to improve activation of the most affected areas (re-activate) or to activate compensatory alternative areas (compensate).

An intensive and tailored program was designed for the patient, including outpatient and home-based exercises. On the clinical reevaluation of the patient, an objective improvement on all the applied scales was depicted. Also, the patient subjectively reported significant improvements on her quality of life, ability to performed daily-life activities and communicative capacities. fMRI reassessment after the intensive speech therapy program depicted global increase in cortical activation, which is related to the fact that the recovery process is a dynamic one, that involves a variety of plastic changes in both hemispheres.[11] In the imagiological reevaluation, a more predominant increase in the right hemisphere was found, which can be explained by the fact that when left hemisphere networks are more severely impaired, the right hemisphere appears to be capable of assuming some language functions, by employing homotopic regions in ways that may mirror some aspects of language processing in the left hemisphere.[9,10] Even though a possible learning effect on the patient's scales punctuations may have been present, the subjective perception and the fMRI improvements were learning-independent findings.

The correlation between clinical improvement and neuroimaging modifications is hard to establish due to intrinsic variability of fMRI related to variations in patient awareness, emotional status and motivation. As so, we highlight that the number of activations on fMRI is, by itself, debatable as a surrogate for neurological recovery. Nevertheless, its' relationship with clinical improvement is valuable information.

Despite the classic view that a plateau of language function occurs within 6–9 months after stroke, changes may occur later, as in this case.[2,11,12] Most theories of post-stroke aphasia recovery are descriptive and lack concrete experimental evidence; a better understanding of mechanisms underlying recovery, preferably in the form of computationally implemented models, is needed to provide mechanistical background for therapeutic strategies' design and implementation.

The relearning of speech is of critical importance to the patients with aphasia who have moderate to severe speech motor problems, as it was the case of our patient.

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