

## IMAGEM EM NEUROLOGIA/IMAGE IN NEUROLOGY

## A Song of a Girl that Endured

## A Canção da Menina que Ficou

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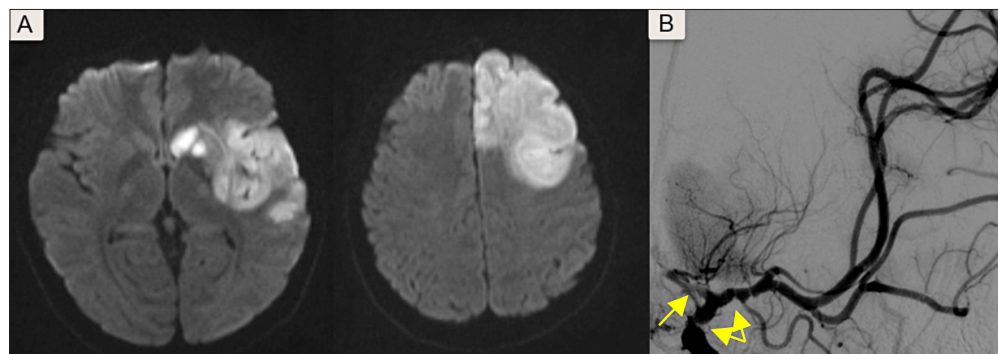
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Language pathways comprise a complex cerebral network of specialized regions involved in language, memory, and motor function.<sup>1</sup> Although propositional speech is predominantly attributed to the left hemisphere, language production engages bilateral cortical and subcortical structures, including both white and gray matter, the basal ganglia, and the thalamus.<sup>1,2</sup> Functional magnetic resonance imaging (fMRI) demonstrates this extensive connectivity, revealing activation of regions in both hemispheres, with distinct patterns depending on whether language is spoken or sung. Consistent with these observations, some patients with acute or chronic aphasia, despite being unable to produce propositional speech, retain the ability to sing.<sup>3</sup>

We report the case of a fourteen-year-old right-handed female adolescent who was ad-

mitted to our emergency department with a seven-hour history of sudden-onset right-sided hemiparesis. She had no relevant prior medical history, recent travel, infections, or vaccinations. Her mother reported a recent moderate upper respiratory tract infection.

On admission, neurological examination revealed mixed aphasia characterized by non-fluent speech, reduced spontaneous verbal output with predominantly elicited speech, anomie pauses, phonemic paraphasias, preserved repetition, and preserved comprehension of simple but not complex commands, as well as moderate right-sided hemiparesis with brachial predominance (pediatric NIHSS score: 4). Cranial computed tomography (CT) was unremarkable, while angio-CT demonstrated segmental stenosis of the left middle cerebral artery (MCA),



**Figure 1.** A. MRI with DWI sequences, confirming the suspicion of left hemisphere stroke with frontal, temporal and parietal diffusion restriction. B. Conventional digital subtraction angiography with intracranial focal stenosis of the left ICA, MCA and ACA (arrows).

specifically in the M3 segment, without evidence of large-vessel occlusion. Initial laboratory investigations were within normal limits, and secondary stroke prevention therapy was initiated.

Brain magnetic resonance imaging (MRI) confirmed an acute ischemic stroke involving the perfusion territories of the left anterior cerebral artery (ACA) and left MCA (**Fig. 1**). Etiological workup, including 24-hour ECG Holter monitoring and transthoracic echocardiography, revealed no abnormalities. Further evaluation of cervical and intracranial vessels with transcranial and cervical Doppler ultrasonography, followed by conventional digital subtraction angiography, identified additional focal stenosis of the left internal carotid artery (ICA) and the A1 segment (**Fig. 1**) of the left ACA, without other significant findings. Laboratory testing was unremarkable except for a positive serum IgM for *Mycoplasma pneumoniae*, with negative cerebrospinal fluid (CSF) analysis.

In the absence of an alternative etiology for acute stroke in an otherwise healthy adolescent and given the presence of focal arterial stenosis and positive *Mycoplasma pneumoniae* IgM serology, a secondary inflammatory vasculopathy was considered the most likely diagnosis. Treatment was initiated with ciprofloxacin 400 mg twice daily and acyclovir 10 mg/kg/dosis for 21 days, combined with high-dose intravenous methylprednisolone (1 g daily for five days), followed by a three-month oral taper.

During the first days of hospitalization, the patient experienced clinical deterioration, with a pediatric NIHSS score increasing to 14. After initiation of intensive physical therapy, she recovered most of her motor deficits but continued to exhibit mixed aphasia, as previously described. It was surprising for her family members that, despite her struggle to speak, she was able to sing effortlessly songs of her favorite artist (**Video 1**).

The production of spoken and sung language engages partially distinct neural substrates, with singing associated with broader and more distributed connectivity. Singing recruits right posterior superior temporal regions for melodic processing, right inferior frontal areas for intoned vocalization, and bilateral sensorimotor circuits for auditory-motor integration.<sup>1,4</sup> When the melody is familiar, additional engagement of the right basal ganglia and associated memory circuits occurs. Thus, singing may involve a distinct and potentially more complex neural network integrating language, music, rhythm, and prosody.<sup>2,4</sup> Preserved singing ability may result from the recruitment of



**Video 1.** Despite having aphasia, the patient is able to sing her favorite song fluently. ([see the video](#))

automatic and formulaic language pathways, procedural memory systems, rhythmic entrainment mechanisms, emotional prosody, and enhanced sensorimotor coupling, thereby bypassing dysfunctional left-hemisphere networks responsible for propositional speech.<sup>4</sup>

This intriguing clinical finding may not only facilitate alternative forms of communication but also support speech rehabilitation strategies.<sup>2,5</sup> Post-stroke language recovery depends largely on neuroplasticity and the capacity of preserved neural networks to reorganize and compensate for injured regions, a process enhanced by activation of distributed language circuits. Consequently, the complexity and redundancy of this pathophysiological network provide a strong rationale for music-based interventions as a core therapeutic tool in post-stroke aphasia rehabilitation, potentially reducing its long-term burden.<sup>3,5</sup> ■

#### Contributorship Statement / Declaração de Contribuição

All authors approved the final version of the manuscript for publication and assume responsibility for all aspects of the work, ensuring the accuracy and integrity of the data presented.

Todos os autores aprovaram a versão final do manuscrito para publicação e assumem responsabilidade por todos os aspectos do trabalho, garantindo a exatidão e a integridade dos dados apresentados.

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#### References / Referências

1. Sidtis DL, Postman WA. Formulaic expressions in spontaneous speech of left and right hemisphere - damaged subjects. *Aphasiology*. 2006;20:411-26. doi: 10.1080/02687030500538148
2. Schlaug G, Marchina S, Norton A. From Singing to Speaking: Why Singing May Lead to Recovery of Expressive Language Function in Patients with Broca's Aphasia. *Music Percept*. 2008;25:315-23. doi:10.1525/MP.2008.25.4.315
3. Martínez-Molina N, Pitkäniemi A, Siponkoski ST, Moisseinen N, Kuusela L, Laitinen S, et al. Functional neuroplasticity in chronic post-stroke aphasia following a singing intervention in a cross-over randomised trial. *Sci Rep*. 2025;15:27639. doi:10.1038/s41598-025-11288-0
4. Whitehead JC, Armony JL. Singing in the brain: Neural representation of music and voice as revealed by fMRI. *Hum Brain Mapp*. 2018;39:4913-24. doi: 10.1002/hbm.24333
5. Stahl B, Henseler I, Turner R, Geyer S, Kotz SA. How to engage the right brain hemisphere in aphasics without even singing: Evidence for two paths of speech recovery. *Front Hum Neurosci*. 2013;7:35. doi: 10.3389/fnhum.2013.00035.