



LECTURE

The neuroplasticity of speech and language early after stroke

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Abstract

More than ninety-five percent of people depend on the left hemisphere for language processing related to grammar, vocabulary, and phoneme construction.

In the early phase of stroke, one third of patients have impairment of speech and language. Global aphasia, which is the complete loss of the ability to understand language, formulate speech, and repeat sentences, or the combination of Broca's, Wernicke's and conduction aphasias, is caused by lesions in the anterior frontal gyrus (Broca's area), upper temporal gyrus (conduction), and posterior regions of language (Wernicke area).

These patients almost do not produce speech and present a serious deficit of auditory comprehension, although they can fulfil properly contextualized commands. It is like "falling asleep" in Portugal and "waking up" in Japan. However, the ability to sing familiar songs is preserved, since musical areas are represented in the non-dominant hemisphere.

Music therapy is a method to treat patients with non-fluent aphasia. Singing ability remains unchanged, with several studies showing that the right hemispherical regions are more active during singing. Nevertheless, Hebert in 2003 showed that singing does not facilitate articulation of words in non-fluent aphasia, suggesting there are two systems for vocal production.

The main pathways for the recovery from aphasia in the small lesions of the dominant hemisphere of language are the recruitment of the perilesional cortex, but, in major lesions, the recruitment and training of rudimentary structures compatible with language in the non-dominant hemisphere is needed.

Music therapy involving melodic elements is considered a potential treatment for non-fluent aphasia, since singing can activate the right hemisphere of patients, compensating the injured left hemisphere.

Both music and language use different sound parameters for their hierarchical sound organization. In spite of their differences, singing and language have both syntactic organization and imply semantic understanding. In aphasia, the preserved ability to sing can result from a cerebral circuit reserved for this purpose, which suggests that singing and speaking involve different neural pathways in the human brain.

Therefore, right hemisphere partial replacement of the injured left hemisphere is one of the possible mechanisms of music therapy in non-fluent aphasia. Stahl has shown that rhythm, rather than singing, is the key element of music therapy that benefits aphasic patients.

Sonic identity is the set of energies, sounds, music and movements that characterize the individual, from his intrauterine life until stroke, providing him with a nonverbal interaction to open channels of communication, stimulating different functions and abilities. This is the basis of the first approach by the speech therapist, in early phase after stroke.

Strategy includes melodic intonation therapy (MIT), brief sentences spoken in melodic sequences, or in recitative, with increasing levels of difficulty, in time and in rhythm, using only two musical tones, where the most acute syllable represents the naturally marked syllable in speech. Each chanted syllable is accompanied by a beat of the left hand to stimulate the right hemisphere. In chronic non-fluent aphasia, left hand movement is used to benefit the verbal articulation in aphasic patients, involving the neurological network that coordinates the movement of the hand and the articulatory movement of the speech in the patients' right hemisphere.

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