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Communication skills and thalamic lesion: Strategies of rehabilitation

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ABSTRACT

Aim: To describe the speech rehabilitation history of patients with thalamic lesions. **Background:** Thalamic lesions can affect speech and language according to diverse thalamic nuclei involved. Because of the strategic functional position of the thalamus within the cognitive networks, its lesion can also interfere with other cognitive processes, such as attention, memory and executive functions. Alterations of these cognitive domains contribute significantly to language deficits, leading to communicative inefficacy. This fact must be considered in the rehabilitation efforts. **Materials and methods:** Whereas evaluation of cognitive functions and communicative efficiency is different from that of aphasic disorder, treatment should also be different. The treatment must be focused on specific cognitive deficits with belief in the regaining of communicative ability, as well as it occurs in therapy of pragmatic disorder in traumatic brain injury: attention process training, mnemotechnics and prospective memory training. **Results:** According to our experience: (a) there is a close correlation between cognitive processes and communication skills; (b) alterations of attention, memory and executive functions cause a loss of efficiency in the language use; and (c) appropriate cognitive treatment improves pragmatic competence and therefore the linguistic disorder. **Conclusion:** For planning a speech-therapy it is important to consider the relationship between cognitive functions and communication. The cognitive/behavioral treatment confirms its therapeutic efficiency for thalamic lesions.

Introduction

In the last century, different functional models have been proposed to synthesize the contribution of anatomical structures to support human language skills, combining essentially a "focal" representation (cortical modules) or "distributed" representation (network models) of those abilities. Having overcome the classical model of language functioning, the Wernicke–Geschwind model was proved empirically inadequate. The idea of "exclusive localization of language areas" was questioned and redefined.

Currently, more and more accurate instrumental investigations show that language functions and communication

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skills are the product of a complex integration between cortical and subcortical circuits that involve the entire central system, forming a large distributed network in different areas of the brain. This network also controls a number of specialized cognitive skills (including attention, memory and executive functions) that support our language [1].

Subcortical structures are, therefore, in a strategic functional position within cognitive networks. Their lesion may interfere with a great number of functions and resulting deficits inevitably affect linguistic abilities.

Among subcortical structures, there is increasing attention about the role of thalamus in high cognitive functions and its participation in linguistic processing.

Crosson, in 1984, described three cardinal features of thalamic aphasia: (1) Decrease of speech output with anomia and semantic paraphasias that could deteriorate into jargon. (2) Auditory-verbal comprehension less impaired than production. (3) Repetition minimally impaired [2].

Over the last several years, case studies and case series of thalamic aphasia have continued to be published [1, 3–14], showing a great variability in language processing, depending on different types of lesions (thalamic hemorrhage or infarction) and diverse thalamic nuclei involved [15].

In general, all information reaching the cortex passes through the thalamus, and thus the thalamus sits in a strategic position for brain processing. Its major role is to gate and otherwise modulate the flow of information to the cortex. Passing information through the thalamus serves a function, not only for language but also for other cognitive processes [16]. The interaction between language and other cognitive domains is an important factor to be considered, especially in lesions affecting structures that have extensive reciprocal connections with the cerebral cortex, such as the thalamic nuclei [1].

The linguistic and communicative disorders caused by thalamic lesions usually escape the possibility of classification and the use of linguistic tests alone can not be sufficient to identify the disturbance, which can lead to therapeutic inefficacy. These deficits are rarely as disabling as those found in cortical lesions but they have a strong impact in subjects' quality of life, proportionally to language use in personal and social daily life, especially in people who carry out professional activities that require a higher level of cognitive-verbal skills, such as lawyers or doctors.

The purpose of this paper is to verify that cognitive/behavioral treatment strategies in thalamic lesions, aimed at the recovery of cognitive domains, create a positive effect on communication skills and therefore an improvement of aphasic disorder.

Materials and methods

We studied in a patient with vascular thalamic lesions the effects of cognitive rehabilitation on her communication skills.

GM was a 50-year-old right-handed woman with 17 years of schooling. She was an Italian native speaker and health worker. She came to our attention in March 2012, thirty days after hospitalization owing to "bilateral thalamic infarction with hemorrhage and edema". The patient was initially evaluated thirty days after thalamic lesion and again three months after an intensive training, three times a week. Her communicative competence was tested at three different times: thirty days after thalamic lesion, about six months after treatment beginning and about one year later.

Instruments: tests for language evaluation

At first speech-therapy visit, language evaluation was performed using a functional interview (Aachener Aphasia Test) [17] where sequence and rough content of the questions are fixed. Questions concern the patients' illness, occupation, family and spare time activities. The discourse is then analyzed with respect to the nature and number of language-related impairments. On this basis Communicative Behavior, Articulation, Prosody, Automatized Speech, Semantic, Phonological and Syntactic Structure of general speech and language are evaluated.

Tests for a detailed linguistic analysis for aphasic patients like Frenchay Aphasia Screening Test (FAST) [18]; and Battery for Aphasic Deficit Analysis (BADA) [19] are also performed, as initial assessment. These tests evaluate the phonological, morphological, syntactic and semantic aspects that are present in language production (naming and repetition) and language comprehension.

Attention, memory and executive functions were evaluated at pre- and post-rehabilitation, through Semantic Verbal Fluency Test [20] and Brief Neuropsychological Examination (ENB) [21]. The Semantic Verbal Fluency Test evaluates lexical recall's ability by generating words for semantic categories, in 120 seconds. The BNE investigates: short-term memory, attentional components, visuospatial skills, working memory, psychomotor speed, logical reasoning and abstraction, long-term memory, visual discrimination, self control, selfmonitoring and motor planning.

The measuring instrument for communicative and pragmatic competence we chose was The Dice Game [22]. The test was devised to assess communication skills following closed-head injury. It consists in one such task in which the subject is required to explain a board game to a naïve listener. The explanation is taped, transcribed and the content is quantified. For higher accuracy, we compared patient's performance with that of five control subjects similar to patient's age, sex and schooling.

Trainings

Aphasia in thalamic lesions can evolve rapidly after a stroke, thus the use of linguistic tests alone may not completely identify the disturbance. For an overall assessment neuropsychological tests for cognitive functioning and then pragmatic tests for communicative aspects of language production usually were also performed. The treatment must be focused on specific cognitive deficit with belief in the regaining of communicative ability. On this basis, the rehabilitation we propose is carried out by subjecting the patient to the following trainings:

1. Attention process training (APT) [23],

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