Noninvasive Brain Stimulation Shows Promise in Poststroke Aphasia

Written by Wayne Kuznar

Noninvasive repetitive transcranial magnetic stimulation (TMS) appears to enhance the effects of speech and language therapy when used in the subacute stage of stroke. Alexander Thiel, MD, McGill University, Montreal, Quebec, Canada, reviewed language recovery and compensatory brain activation following stroke and presented preliminary data for repetitive TMS to contralateral homotopic speech areas to aid speech and language.

The rationale behind the use of TMS in chronic aphasia is inhibition of abnormally activated areas of the language network. Right hemispheric activation has been described as a compensatory mechanism that occurs within days after a stroke, and this activation is associated with poorer language performance compared with patients who reintegrate the left hemisphere, said Prof Thiel. Repetitive TMS aims to restore the left-hemispheric language network by inhibiting the overactive right homotopic frontal speech areas.

Evidence for an inhibitory mechanism comes from a study employing TMS interference in normal subjects during a verb generation test [Thiel A et al. *J Cereb Blood Flow Metab.* 2006]. Regional cerebral blood flow was decreased in the left inferior frontal gyrus (IFG) on positron emission tomography imaging during the test with delivery of 1-Hz TMS impulses to the left IFG, and cerebral blood flow was simultaneously increased in the right IFG.

A pilot trial of therapeutic repetitive TMS was undertaken in 24 patients with subacute poststroke aphasia; patients were randomized to 10 days of inhibitory 1-Hz repetitive TMS to the right posterior IFG or sham stimulation, followed by speech and language therapy [Thiel A et al. *Stroke.* 2013]. Significantly greater improvement in the Aachen Aphasia Test composite score was observed in TMS-treated patients ($P = .003$), consistent with a predicted shift in brain activity in functional neuroimaging. The TMS group experienced a reconstitution of the network in the left hemisphere, concluded Prof Thiel.

Julius Fridriksson, MD, University of South Carolina, Columbia, South Carolina, USA, continued with a discussion of transcranial direct current stimulation (tDCS) as a means to improve treatment outcome in aphasia. Anodal tDCS was tested in 10 patients with chronic aphasia of various types and severities in a double-blinded crossover design (1 week of anodal tDCS and 1 week of sham tDCS) [Baker JM et al. *Stroke.* 2010]. The outcome measure was performance on a computerized naming test and a determination of generalization from treated to untreated items. Significantly more treated items were named correctly following anodal tDCS compared with sham tDCS ($P = .04$). More untreated items were also named correctly following anodal tDCS compared with sham tDCS, although this difference did not achieve significance ($P = .07$). The treatment response varied widely, however, with no difference in response between active treatment and sham in 4 of the 10 patients; 1 patient had no response to either condition.

In a second study, tDCS seemed to enhance the effect of behavioral aphasia treatment in 8 chronic stroke patients with fluent aphasia, in the form of reduced reaction time during naming of trained items immediately after treatment and 3 weeks later [Fridriksson J et al. *Stroke.* 2011].

At the University of South Carolina, 3 weeks of anodal tDCS of the left hemisphere is being studied in a phase 2 trial of 74 patients with aphasia, with the primary outcome being performance on the Philadelphia Naming Test. More studies are needed to define the optimal dosage and format of tDCS as well as to better understand the patients who benefit from this treatment.

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