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Editorial Comment—Implementing Results of Stroke Recovery Research Into Clinical Practice

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Editorial Comment

Implementing Results of Stroke Recovery Research Into Clinical Practice

Most patients show some recovery of deficits in the weeks-months following a focal infarct. Numerous studies have characterized the molecular, cellular, systems, and behavioral level[1–3] brain changes related to this recovery. In the current article, Ilvonen et al,[4] using mismatch negativity (MMN), describe an evolution of brain physiology that paralleled recovery of language. Consistent with prior studies using functional MRI (fMRI)[5] or positron emission tomography (PET),[6] these authors found changes in brain function within both hemispheres as language improved. Apart from new information on brain reorganization gained from this investigation, this report has significance in at least 2 other ways: only passive patient participation was needed to probe the brain, and the methods employed can be easily implemented in thousands of medical facilities worldwide.

MMN is a type of auditory-evoked potential that reflects cerebral processing of changes in the acoustic environment. An auditory stimulus is presented while scalp electrodes record cortical potentials. A change in the auditory stimulus pattern is then introduced, which results in a negative deflection over characteristic brain areas such as frontal or temporal lobes. This deflection represents an objective measure of auditory and language processing that can be elicited in the absence of attention.[7,8] MMN has provided insights into brain function in a number of brain states,[9] including conditions in which studying brain physiology can be otherwise difficult, such as schizophrenia[10] and sleep.[11]

Most methods used to map brain function demand cooperation from the patient being examined. Thus fMRI, PET, and transcranial magnetic stimulation (TMS) study paradigms require patients to actively perform a behavior on cue. The need for such active participation narrows entry criteria (a patient who cannot do the required behavior on command cannot be in the study), and also allows an influence on results by effort, fatigue, attention, cooperation, comprehension, strategy, and other variables. Even in healthy subjects, these variables can have a substantial effect on brain mapping results. For example, shifting the direction of gaze by 20° to 30° during right finger movements modulates the volume of activation in left primary motor cortex by >50%.[12] The MMN brain mapping approach employed by Ilvonen et al[4] is limited in several regards, such as spatial resolution. The authors do not provide measures of intersubject variance. Also, additional studies are needed regarding the reliability of this method in various stroke populations. Nevertheless, application of MMN to patients with an evolving neurological deficit is of particular value because this means of probing brain function is little influenced by behavioral variables such as attention.[7,8]

A broad range of molecular, cellular, physiotherapy, and other treatments that target restorative brain events are being developed to improve outcome after stroke. Will these be administered in a one-size-fits-all approach, as with aspirin after stroke? More likely, therapy will be individualized on the basis of clinical data plus a measure of the physiological target, as has been suggested when selecting patients for revascularization or for acute neuroprotective therapies. Examples of this approach in other clinical practice settings include thyroxine dose based on serum assessment of pituitary function and cardiac anti-arrhythmia medication selection based on electrophysiological laboratory studies.

Brain mapping studies employing fMRI, PET, or TMS continue to provide new insights into how the brain changes function in relation to neurological gains after stroke. However, it is unlikely that such methods will enjoy broad application in general neurological practice. If recovery-related processes are to be measured in order to best implement future restorative therapies, what techniques will be used?

Evoked potentials can currently be obtained in hospitals around the world and have demonstrated clinical utility in even complex medical settings. For example, the absence of somatosensory-evoked potentials virtually ensures that a patient with hypoxic-ischemic coma will not awaken.[13] Evoked responses have been previously used to study stroke recovery; however, the study by Ilvonen et al[4] is important by virtue of the number of physiological assessments over time and inclusion of a valid behavioral measure. While a range of investigative methods continue to be needed for a better understanding of brain reformatting after stroke, a parallel need exists to characterize accessible methods such as MMN that might be used to reliably measure restorative events in the day to day treatment of individual patients. The MMN study by Ilvonen et al,[4] in addition to further characterizing return of language function after stroke, is an important step toward this goal.

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