Journal of the International Neuropsychological Society (2006), **12**, 130–131.

DOI: 10.1017/S1355617706060243

NEUROBEHAVIORAL GRAND ROUNDS—INTRODUCTION

Understanding diversity: A multimodal approach to good and poor aphasia therapy outcomes

MURRAY GROSSMAN
Department of Neurology, University of Pennsylvania School of Medicine

Aphasia is extraordinarily common. Over one million people in the US currently suffer from aphasia. The personal and societal costs associated with aphasia are enormous. We live in a highly verbal world, and compromised language communication limits the aphasic's participation in society. Activities associated with a reasonable quality of life are highly constrained, and significant depression and other psychological costs are frequent. From a financial perspective, it is the aphasic's limited communicative capacity—not an associated motor disorder—that constrains employment and the ability to contribute productively to society. Thus, there are many reasons to pursue aphasia therapy. Yet effective aphasia therapies are few. Despite the frequency of aphasia and its enormous costs, resources devoted to the treatment of aphasia have been disappointingly modest.

Scientific advances now make it feasible to respond forcefully to the call for new approaches to aphasia therapy. In particular, animal models and imaging investigations in humans have improved our understanding of the neural mechanisms underlying recovery of function following stroke. One mechanism involves recruitment of areas around a stroke to support language; a second mechanism involves activation of contralateral homologues in the right hemisphere. This work can help us understand the neural basis for a language disorder and the natural history of cortical reorganization following a stroke. Moreover, new approaches to aphasia therapy may involve the systematic recruitment of these mechanisms during novel treatments of aphasia.

The work described in this Neurobehavioral Grand Rounds by Wierenga and her colleagues challenges conventional approaches to therapy for aphasia. Despite many obstacles, these researchers were overwhelmingly successful in answering key questions regarding aphasia treatment. Wierenga and her multidisciplinary team of investigators ask two key questions in their presentation: What would a successful aphasia therapy look like? and how can the efficacy of this therapy be optimized across a phenomenologically diverse group of aphasics? The team of researchers identified mapping therapy as a potentially successful way to improve meaningful production in two chronic aphasics. This therapy targets the essence of communication—conveying who is doing what to whom. Aphasics thus are trained to associate specific noun phrases with the agent and recipient thematic roles of a sentence. To achieve this goal, the research team employed a staged approach. First, the patient is introduced to the material in an errorless learning environment. This is followed by a more traditional approach to training that allows the production of errors that are corrected by the therapist. This initial phase involves active voice sentences where noun phrases are ordered so that the agent occurs first. A subsequent phase involves errorless and errorful training of passive voice sentences, where order of mention of nouns in a sentence cannot be used as a strategy to bootstrap accurate agent and recipient mapping. The investigators show reasonably successful acquisition of performance targets during the course of therapy in these two aphasics. However, only one of these individuals is able to generalize this to untrained tasks such as producing narrative discourse.

To address the divergent outcomes in the two participating aphasics, the researchers studied brain activation before and after therapy with functional magnetic resonance imaging (fMRI). This technique uses an endogenous tracer—iron molecules in hemoglobin—to monitor blood flow to cortical regions that are recruited during cognitive activity. The investigators elected to monitor cognitive activity that is identical to their therapeutic goal—sentence production. They found that the aphasic who successfully generalized mapping therapy to untrained tasks was able to increase activation in left inferior frontal cortex following treatment relative to activation of this area prior to treatment. However, the aphasic who did not generalize to untrained tasks following therapy did not show increased brain activation following therapy in language-related cortical regions.

In addressing the questions of therapeutic efficacy and generalization across aphasic subgroups, this team of investigators should be lauded for overcoming many challenging hurdles. First, they were able to demonstrate successful appli-

cation of a principled form of language remediation to chronic aphasics through the use of an errorless form of therapy. The success of their approach is demonstrated in its generalization to unrelated language production tasks such as narrative discourse, although future work will need to assess the long-term savings associated with this labor-intensive therapeutic procedure. Secondly, the investigators had the great foresight to monitor brain activity before and after therapy so that they could begin to determine why their approach to therapy may—or may not—have worked. The interpretation of cortical activation in the successful aphasic is straightforward, and provides important justification for pursuing their therapeutic approach. This aphasic apparently was able to up-regulate functioning of an essential language region. Understanding the basis for failure to generalize in the unsuccessful aphasic is equally important. The unsuccessful aphasic in fact demonstrated several significant changes following therapy. This aphasic appeared to activate several brain regions that were not previously recruited, and decreased activation also was seen following treatment in several previously recruited regions. The interpretation of these results would have benefited from a clearer picture of exactly what to expect in neurologically intact seniors during such a methodologically challenging protocol.

In this Neurobehavioral Grand Rounds, the authors provide a successful demonstration of an important therapeutic intervention while they address an elusive scientific question. This synergistic approach to therapy and scientific inquiry is most impressive. It is the frequently neglected patients with aphasia, however, who are the greatest beneficiaries of this work. I am sure that Wierenga and her colleagues find this to be the most satisfying outcome of the investigation.