NeuroQuant® Revealed Hippocampal Atrophy in a Patient With Traumatic Brain Injury

To the Editor: This report describes the case of a 57-year-old man who was in an accident in which his vehicle was rear-ended by a tractor-trailer, leading to traumatic brain injury (TBI) and other injuries. His MRI brain data were analyzed with NeuroQuant®,[1] an FDA-approved method for measuring brain volume.

Case Report

At the time of the accident, he hit his occiput and suffered whiplash. He was dazed but did not lose consciousness. He had posttraumatic amnesia, headache, neck pain, and dizziness. In the emergency room, his Glasgow Coma Scale score was 15/15. Over the following days and weeks, he had multiple persistent neuropsychiatric symptoms, including distractibility, impaired short-term and long-term memory, impaired visuospatial abilities, insomnia, fatigue, and blurry vision. Neuropsychological testing confirmed impairments in memory and other cognitive abilities. Nine months after the accident, an MRI of the brain was interpreted in the traditional manner (that is, by visual inspection of the images) by the radiologist as showing two nonspecific T_2 hyperintensities in the left frontal lobe. NeuroQuant® volumetric analysis of the same MRI data revealed that total hippocampal volume was 4.37 cm^3, which was 0.29% of intracranial volume, falling below the first percentile, as compared with an age-matched normal-control group. The patient continued to work full-time at a job he had held for many years; however, his functioning was significantly impaired.

Discussion

The patient satisfied diagnostic criteria of Kay et al.[2] for mild TBI. The traditional interpretation of the MRI as showing nonspecific findings is a common result in patients with mild TBI. In contrast, NeuroQuant® volumetric analysis revealed markedly reduced hippocampal volume, consistent with atrophy due to traumatic brain injury. TBI is well known to cause hippocampal atrophy.[3] The hippocampus is well known to be a key brain area for memory. The hippocampal damage in this patient probably caused his posttraumatic amnesia and short-term memory impairment. Therefore, for this patient, there was convergent evidence (based on clinical interview, neuropsychological testing, brain MRI, and the literature) that his sudden onset of memory problems after the accident was due to hippocampal damage as part of mild TBI. The NeuroQuant® brain volumetric analysis was useful for identifying hippocampal atrophy despite the fact that the radiologist's traditional interpretation failed to do so. These two techniques are complementary: NeuroQuant® is better for measuring volume and comparing the data with a normal-control group;[4,5] the radiologist's traditional interpretation is better for identifying patterns and detecting problems related not only to volume but to many other aspects of brain structure. Furthermore, NeuroQuant® is a commercially-available software program that is computer-automated and allows brain volume analysis in about 15 minutes. Therefore, it has important practical advantages over other brain volumetric techniques, which are labor-intensive or confined to research settings. Overall, NeuroQuant®, in combination with the traditional approach, may prove to be a useful addition to the tools for understanding the effects of TBI.

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