Will diffusion tensor imaging assess rewiring in PVS’ brains?

Sir,

Voss et al published a striking article of two minimally conscious state (MCS) cases studied by diffusion tensor imaging, proposing a possible axonal rewiring mechanism which could explain late recoveries in these cases. Their first case showed a progressive recovery with consequential reduction in disability over nearly 20 years. These authors described a second patient as remaining in a vegetative state for over a year, ensuing afterwards to a MCS.[1] The crux of the problem lies in the determination of a person’s internal mental state using external proof. Hence, a question arises about the possible late recovery of awareness in vegetative state cases.

Schiff et al documented remaining modular functioning of individual functional networks in five persistent vegetative state (PVS) cases with a clinical evolution ranging from six months to 25 years; they concluded that this activity by isolated modules is not enough to generate consciousness in devastatingly damaged brains.[2] In contrast, Kotchoubey et al reported a percentage of PVS patients having a P3 or P600 evoked potentials waves, suggesting activity in association cortical areas. These authors also documented a case of late recovery of awareness after being fully vegetative during 20 months.[3]

These dissimilar conclusions might be due to the difference in time and space resolutions when assessing brain function either by neurophysiologic or other neuroimaging methods. It is well known that event-related potentials and other neurophysiologic techniques have a high time resolution, which allows assessing early brain functional changes, in the time dominion of milliseconds, contrary to cerebral blood flow measurements achieved by functional magnetic resonance images, positron emission tomography and single photon emission tomography, which only assess metabolic and functional changes in the brain in periods of seconds and minutes. Moreover, the lower spatial resolution of neurophysiologic methods may be resolved by calculating event-related potentials and EEG with quantitative electric tomography, which integrates the high time resolution of electrophysiological measurements and the spatial-anatomical information provided by magnetic resonance images.[4]

Persistent vegetative state and MCS patients warrant unique problems for diagnosis, prognosis, treatment and everyday management. Therefore, the development of new rehabilitation methods for PVS patients and others suffering long-lasting effects of brain injury, is a crucial challenge for neuroscientists.

Hence, diffusion tensor imaging,[1] combined with other neuroimaging techniques, such as quantitative electric tomography,[4] will represent powerful tools for an objective measurement of neural repair and rewiring in cases suffering severe brain damage.

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