

NEUROCRITICAL CARE

Differentiating minimally conscious and vegetative states

Differential diagnosis of disorders of consciousness—such as the vegetative state, in which patients completely lack conscious awareness, and the minimally conscious state (MCS), which involves weak indications of consciousness—is challenging. MRI measures of global brain connectivity could prove a useful diagnostic tool in this context, according to a recent study by Christian Schwarzbauer and colleagues.

The study involved six patients in the vegetative state and six patients in the MCS, who were diagnosed on the basis of extensive clinical testing. Emotive auditory stimuli consisting of pain cries, as well as control auditory stimuli, were presented to the patients and to 17 healthy controls. MRI scanning was used to measure brain responses and define a map of the weighted global connectivity in each participant, which describes the connectivity of each voxel with all other voxels in the brain.

Statistical comparison of the connectivity maps between the groups highlighted seven clusters of voxels with significantly higher connectivity in patients in the MCS compared with those in the vegetative state. By contrast, standard task-related functional MRI, which focuses on brain activation

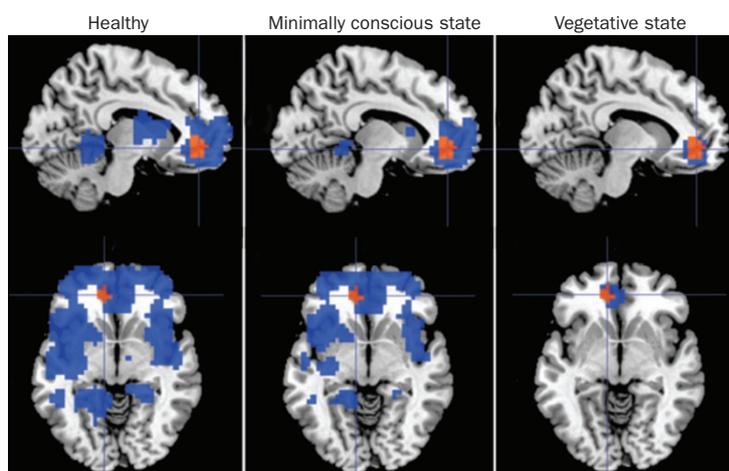
induced by a specific task, showed no intergroup differences.

Next, the researchers used the identified voxel clusters as ‘seed’ regions for determination of related functional brain networks. “An advantage of this method is that the seed region is not chosen by the researcher, but rather is purely data-driven,” says Schwarzbauer. Importantly, the vegetative state group showed no long-range functional network connections, whereas patients in the MCS had functional networks with similar topology to those of healthy controls, albeit with reduced spatial extent.

“Our findings are consistent with the hypothesis that high-level brain function, such as consciousness, requires global integration of functionally specialized local units,” comments Schwarzbauer. The next step, he says, will be to develop diagnostic tools that are not restricted to comparisons between groups, but rather are informative at the level of individual patients with disorders of consciousness.

Katie Kingwell

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Functional connectivity MRI shows long-range functional networks in the minimally conscious state similar to healthy controls, which are absent in the vegetative state. Image courtesy of C. Schwarzbauer.