

EDITORIAL

**Cogito Ergo Sum by MRI**

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What is left of the human being when the brain is badly damaged has been a question for philosophers and theologians. Now, however, an imaginative series of experiments using functional magnetic resonance imaging (MRI) of the brain, culminating in the article by Monti and colleagues in this issue of the *Journal*,¹ has revealed a form of preserved cognition in ostensibly unconscious patients.

The unfortunate term “vegetative” has been used to describe patients whose eyes open after a period of coma but who lack any meaningful responses to stimuli. Open eyes give the impression of normal alertness, but the patient’s behavioral repertoire is limited to reflexive actions such as posturing or purposeless movements, roving eye movements, swallowing, and yawning. A task force has suggested that the term “persistent vegetative state” be used to describe patients who remain in a vegetative state for more than 3 months after an anoxic brain injury or 12 months after cranial trauma, since improvement after these periods is highly unlikely.² The more recently introduced term “minimally conscious state” refers to limited, erratic, but meaningful verbal and motor responses to commands or environmental circumstances. The difference between these two states is fundamental only if one attributes different degrees of conscious experience to each.

It is known that exposure to personally meaningful information such as a patient’s own name (but not other names) activates the cerebral cortex in some patients in a vegetative state.³ Although this activation is surprising, it does not necessarily reveal conscious experience.

In the study reported by Monti et al., one of two parts of the cerebrum was induced to activate

in 5 of 54 unresponsive or minimally responsive patients. This activation was cued by verbal instructions to think about navigating one’s home or a familiar city or to imagine playing tennis. Moreover, the regions activated were the same in unresponsive persons and in healthy control subjects. The authors have described this ability to detect awareness by means of functional MRI before,⁴ but here they report the frequency of the finding. Even in a preselected population, brain activation was infrequent, but it occurred often enough that it will now be difficult for physicians to tell families confidently that their unresponsive loved ones are not “in there somewhere.”

The error rate in the clinical diagnosis of the vegetative state is high, and Monti et al. indicate that some patients who were initially classified as being in a vegetative state but who showed volitional cortical activation had behavioral responses when reexamined that put them into the category of minimal consciousness. This finding emphasizes that clinicians should make these pronouncements only after detailed and repeated examinations. Previous studies have also shown that cortical activation in response to meaningful stimuli and imagined activities indicates a likelihood of awakening. These data suggest that functional MRI might supplement conventional neurologic examination in the classification and prognosis of patients with coma.

A potential logical flaw clouds this surreal circumstance of trace brain patterns of apperceptive experience without the ability to signal consciousness. In response to a previous article regarding the same findings, Nachev and Husain⁵ point out that “the presence of brain activation is not sufficient evidence for the associated behavior —

here, supposedly consciously mediated behavior — unless one has also shown that the same activation cannot occur without it. . . . [I]nstead of comparing responses to the instructions to ‘imagine playing tennis’ with ‘relax,’ the authors could have compared ‘imagine playing tennis’ with ‘do not imagine playing tennis.’ All the activation reported in the patient could therefore have been wholly automatic and unconscious.”⁵ Thus, the functional imaging changes might be a shadow on a wall. There are, however, more persuasive arguments that the effects seen on functional imaging in one of the patients described by Monti et al. establish true communication.

Watching a relative or friend in a vegetative or minimally conscious state is anguishing and often a source of dissension within families and between physicians and families. The first and obvious use of mental signaling by means of functional MRI could be to preserve the patient’s autonomy by querying his or her wishes regarding continued medical care. At the same time, functional imaging might give solace to families who understandably misinterpret the patient’s countenance of alertness, movements, visual tracking, and reflexive actions as implying a mental life. More likely, from my experience, magnetic resonance images will be no more persuasive to hopeful families than the physician’s pessimistic clinical assessment. It will always be more difficult to prove the lack of a mental life than to demonstrate its presence.

Research on clinically undetected consciousness is easily subject to overinterpretation and sensationalism that the authors certainly do not intend. In discussions with families and in physicians’ capacity as spokespersons to society on these matters, three points should be emphasized. First, in this study, brain activation was detected in very few patients. Second, activation was found only in some patients with traumatic brain injury, not in patients with global ischemia and anoxia. Third, cortical activation does not provide evidence of an internal “stream of thought” (William James’s term), memory, self-awareness, reflection, synthesis of experience, symbolic representations, or — just as important — anxiety, despair, or awareness of one’s predicament. Without judging

the quality of any person’s inner life, we cannot be certain whether we are interacting with a sentient, much less a competent, person. Moreover, persons who look to this study to justify continued and unqualified life support in all unresponsive patients are missing the focus of the findings.

In the future, a functional imaging system that supplements clinical observation could classify unresponsive patients, but it will be subject to the same limitations of specificity and sensitivity that prejudice the neurologic examination. Even so, a new vocabulary of terms to describe unconsciousness will be needed to supplant the coarse descriptive one now in use. The terms “consciousness” and “unconsciousness” will no longer bracket a spectrum of states from awake to drowsy to stupor to coma as if there were a continuum similar to that of creatinine levels in renal function. Instead, ensembles of modular brain functions will add up to consciousness of different degrees and varieties, and the line between consciousness and unconsciousness will be blurred. The presence of some rudimentary preserved cognition that is indicated by means of functional MRI will no longer be in question, but its meaning will continue to be subject to interpretation.

The mind is an emergent property of the brain and cannot be “seen” in images. The article by Monti et al. is provocative; however, physicians and society are not ready for “I have brain activation, therefore I am.” That would seriously put Descartes before the horse.

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