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Signs of Awareness Seen in Brain-Injured Patients

By BENEDICT CAREY

Thousands of brain-damaged people who are treated as if they are almost completely unaware may in fact hear and register what is going on around them but be unable to respond, a new brain-imaging study suggests.

The findings, if repeated in follow-up experiments, could have sweeping implications for how to care best for these patients. Some experts said the study, which appeared yesterday in the journal *Neurology*, could also have consequences for legal cases in which parties dispute the mental state of an unresponsive patient.

The research showed that the brain-imaging technology, magnetic resonance imaging, can be a powerful tool to help doctors and family members determine whether a person has lost all awareness or is still somewhat mentally engaged, experts said.

"This study gave me goose bumps, because it shows this possibility of this profound isolation, that these people are there, that they've been there all along, even though we've been treating them as if they're not," said Dr. Joseph Fins, chief of the medical ethics division of New York Presbyterian Hospital-Weill Cornell Medical Center. Dr. Fins was not involved in the study but collaborates with its authors on other projects.

Other experts warned that the new research was more suggestive than conclusive, and that it did not mean that unresponsive people with brain damage were more likely to recover or that treatment was yet possible.

But they said the study did open a window on a world that has been neglected by medical inquiry. "This is an extremely important work, for that reason alone," said Dr. James Bernat, a professor of neurology at Dartmouth.

Dr. Bernat said findings from studies like these would be relevant to cases like that of Terri Schiavo, a Florida woman with brain damage who has been kept alive for years against her husband's wishes. In that case, which drew the attention of Gov. Jeb Bush and the Legislature, relatives of Ms. Schiavo disagreed about her condition, and a brain-imaging test - once it has been standardized - could help determine whether brain damage has extinguished awareness.

The patients in question have significant brain damage. Three million to six million Americans live with the consequences of serious brain injuries, neurologists said. An estimated 100,000 to 300,000 of them are in what is called a minimally conscious state: they are bedridden, cannot communicate and are unable to feed or care for themselves, but they typically breathe on their own.

They may occasionally react to instructions to blink their eyes or even reach for a glass, although such responses are unpredictable. By observing behavior in a bedside examination, neurologists can determine whether a person is minimally conscious or in a "persistent vegetative state" - without awareness, and almost certain not to recover.

In the study, a team of neuroscientists in New York, New Jersey and Washington, D.C., used imaging technology to compare brain activity in two young men determined to be minimally conscious with that of seven healthy men and women. In a measure of overall brain activity, the two groups were vastly different: the two minimally conscious men showed less than half the activity of the others.

But the researchers also recorded an audiotape for each of the nine subjects in which a relative or loved one reminisced, telling familiar stories and recalling shared experiences. In each of the brain-damaged patients, the sound of the voice prompted a pattern of brain activity similar to that of the healthy participants.

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"We assumed we would get some minimal response in these patients, but nothing like this," said Dr. Nicholas Schiff, an assistant professor of neurology and neuroscience at Weill Cornell Medical College in Manhattan and the study's lead author. The two men showed near-normal patterns in the language-processing areas of their brains, Dr. Schiff said, suggesting that some neural networks "could be perfectly preserved under some conditions."

Although the number of patients studied was very small, the specificity and intricacy of the patterns made it all but impossible that the results were a fluke, said Dr. Joy Hirsch, director of the Functional MRI Research Center at Columbia University Medical Center and the study's senior author.

One of the two minimally conscious men lay still in a brain-imaging machine while his sister recounted his toast at her wedding and recalled times playing together as children. Although his eyes were closed, the researchers found that visual areas of his brain were active, suggesting that he might have been producing images, Dr. Hirsch said.

"We do not know for sure what is happening in this man's head, but if he were imagining things at the sound of his sister's voice, that would suggest some connection to emotion," Dr. Hirsch said.

Since the study was completed, Dr. Hirsch said, the team has run the same kinds of tests on seven similar brain-injury patients, with similar results: the language processing networks in their brains display seemingly normal patterns upon their hearing the voice of a loved one. The government has provided financing for the team to conduct a larger study of mental activity in minimally conscious people.

A better understanding of brain patterns in minimally conscious patients should also help cut down on misdiagnosis by doctors, Dr. Fins said. He said one study had found that as many as 30 percent of patients identified as being unaware, in a persistently vegetative state, were not. They were minimally conscious.

Moreover, mental states can change over time, and some patients have almost completely recovered function after being thought vegetative. Brain imaging would be one way to track these changes, and even link them to efforts at treatment. Doctors have no cure for either a minimally conscious or persistently vegetative state.

"The most consequential thing about this is that we have opened a door, we have found an objective voice for these patients, which tells us they have some cognitive ability in a way they cannot tell us themselves," Dr. Hirsch said. The patients are, she added, "more human than we imagined in the past, and it is unconscionable not to aggressively pursue research efforts to evaluate them and develop therapeutic techniques."