Who will wake up from a coma? Electrical jolts in the brain offer hints

Enlarge / Healthcare worker sets up an EEG on an ICU patient.

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Researchers may have found a way to detect inklings of consciousness in comatose and vegetative patients just days after they experience a brain injury—and it appears the method may help predict which patients will rouse and recover in the months afterward.

A team of researchers in New York recorded electrical activity in the brains of unresponsive patients while giving them simple spoken commands, such as “keep opening and closing your right hand” or “wiggle your toes.” Of 104 unresponsive patients tested, 16 (15%) showed some activity. Of those 16 patients, eight of them (50%) went on to be able to follow spoken commands by the time they left the hospital. A year later, seven of them (44%) were able to function independently for at least eight hours at a time. By contrast, only 14% of those who showed no electrical activity early on reached that level of recovery after a year. The results were published this week in the New England Journal of Medicine.

The study was small, and the authors caution that the results “require validation in larger, multi-center studies that are

powered to detect differences in long-term outcomes." But, if the findings hold up, the study could offer clinicians a way to help assess which patients may be able to emerge from a coma or vegetative state.

Muted responses

The study isn't the first to find that some otherwise unresponsive patients show brain activity to spoken commands that doesn't seem to get translated to behavior, that is, actually wiggling their toes, for example. Researchers call such a disconnect "cognitive-motor dissociation," and a 2016 meta-analysis of dozens of studies have estimated that it occurs in about 14% of chronically unresponsive patients. That's close to the prevalence that the New York team found.

The electrical activity appears to be a response to the spoken commands and, perhaps, is the brain recognizing and attempting to actually carry out the orders. But, as the New York researchers note, "whether the detected signal represents recognition or comprehension of commands is uncertain." Researchers also remain uncertain as to whether the detected activity has any bearing on patients' outcomes.

The new study tries to get at this question by following up with the patients over a year. All the work was conducted in a single intensive care unit with patients admitted between 2014 and 2017. Unresponsive patients were screened and tested in their first few days in the hospital. Researchers enrolled patients who were in a coma, in a vegetative state, or in a "minimally conscious state–minus" state, in which certain low-level behaviors are preserved. These include being able to follow moving objects with their eyes, visually fixate, and respond to pain or discomfort.

The cause of these conditions in the enrolled 104 unresponsive patients varied. Some patients had experienced cardiac arrest, while others had suffered traumatic brain injuries or

hemorrhages.

Eye-opening jolts

The researchers used a common, relatively easy-to-use test to assess brain activity: an electroencephalogram. Also known as an EEG, it picks up electrical pulses using electrodes attached to the scalp (in this case, a standard assembly of 21 electrodes was used). EEGs are often used to diagnose epilepsy, assess brain activity after a stroke, or during sleep disorders.

The researchers conducted the tests in 25-minute spoken-command sessions, testing the 104 unresponsive patients along with 10 healthy people as a control group. Of the unresponsive patients, 16 showed electrical activity while 88 did not. Over the following year, six with EEG activity and 50 without it died, some because they were taken off of life support (four and 24, respectively).

But seven of the original 16 with EEG activity rallied and reached a recovery level scored as a 4 or higher on the Extended Glasgow Outcome Scale. This is a clinical scale that ranks outcomes of brain injuries from 1 (dead) to 8 ("upper good"), which is generally a resumption of normal life. A score of 4 is considered "upper severe disability." Patients with this score are dependent for daily support but can be left at home alone for eight or more hours. While 44% (seven patients) with EEG activity after injury made it to a 4 or higher in a year, only 14% (12 of the 88 patients) without EEG had a 4 or higher. The study was not large enough to link such outcomes to any causes of brain injuries.

NEJM, 2019. DOI: 10.1056/NEJMoa1812757 (About DOIs).

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