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Research explains how some patients in a vegetative state can retain awareness, despite being unable to respond with movement.

New insight into a vital cerebral pathway has explained how some patients in a vegetative state are aware despite appearing to be unconscious and being behaviourally unresponsive.

The findings, published in *JAMA Neurology*, identify structural damage between the thalamus and primary motor cortex as the obstacle between covert awareness and intentional movement.

The team of researchers hope that their study, the first to understand the phenomenon, will pave the way for the development of restorative therapies for thousands of patients.

Dr Davinia Fernández-Espejo, from the University of Birmingham, explained, “A number of patients who appear to be in a vegetative state are actually aware of themselves and their surroundings, able to comprehend the world around them, create memories and imagine events as with any other person.”

“However, before we take the crucial step of developing targeted therapies to help these patients, we needed to identify the reason for the dissociation between their retained awareness and their inability to respond with intentional movement.”

“In highlighting damage to the pathways that physically connect the thalamus, one of the hubs of consciousness if you will, and the motor cortex, which drives our voluntary muscular activity, as the reason behind the dissociation we have provided an important explanation”.

A patient who produced repeated evidence of covert awareness across multiple examinations, despite being in a vegetative state for over 12 years, was observed in a case study at the imaging centre at the Brain and Mind Institute, at the University of West Ontario (Canada).

A fellow patient with similar clinical variables, but capable of intentional movement, and 15 healthy control volunteers were also monitored using functional magnetic resonance imaging (fMRI) and fiber tractography.

Participants were asked to respond to commands, for example, asking them to imagine moving their hand in response to the keyword “move”, while their brain activity was measured. Additionally, the researchers assessed the integrity of the structural pathways that were revealed as essential for successful motor execution (those connecting the thalamus with the motor cortex).

Dr Fernández-Espejo added, “The ultimate aim is to use this information in targeted therapies that can drastically improve the quality of life of patients. For example, with the advances being made in assistive technology, if we can help a patient to regain even limited movement in one finger it opens up so many possibilities for communication and control of their environment.”

Though it may be a number of years before an effective therapy is developed, the team believe that a significant milestone has been reached with the discovery.

Dr Fernández-Espejo is working to consolidate this research at Birmingham, which is the ideal setting due to the regional concentration of academic and clinical expertise, care homes who monitor the long term care of severe brain injury patients and world class facilities available between the

University and University Hospitals Birmingham NHS Foundation Trust; including the Birmingham University Imaging Centre and Institute of Translational Medicine.