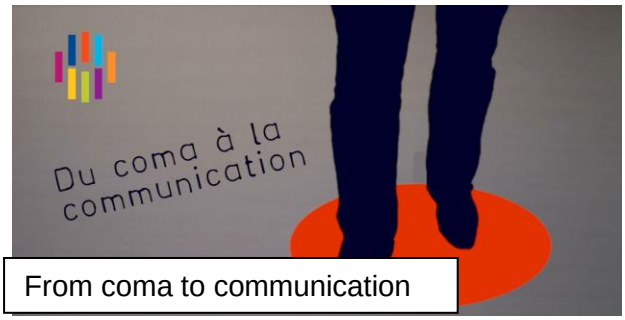
Paris, 11 November 2015

Press release

An indicator for predicting emergence from coma

It is difficult to judge the progress of patients in a coma following head trauma or recovery from cardiac arrest. Researchers from Unit 825, "Brain imaging and neurological handicaps" (Inserm/Université Toulouse III – Paul-Sabatier), in collaboration with Toulouse University Hospital, show that the quality of communication between two structures in the brain predicts patient recovery at 3 months. This new indicator, obtained by conducting MRI analysis on the brain of patients at rest, may provide additional help in establishing a prognosis.

Results of this study are published in the 11 November issue of the journal *Neurology*.



From coma to communication

See video on the discovery presented by Patrice Péran, Inserm Research Fellow

Consciousness appears to be a complex mental process, inseparable from our existence. In reality, this capacity is relatively unstable. It disappears in a cyclical manner during the day (wake-sleep), and can be modified by administering certain drugs (anaesthesia). Finally, it can be abolished more or less completely and permanently following an insult to the brain; this happens in a coma. It is very difficult to determine which patients will emerge from such a situation and regain a normal state of consciousness, and conversely, which will be left with major neurological sequelae leading to serious disability (vegetative state, state of minimal consciousness).

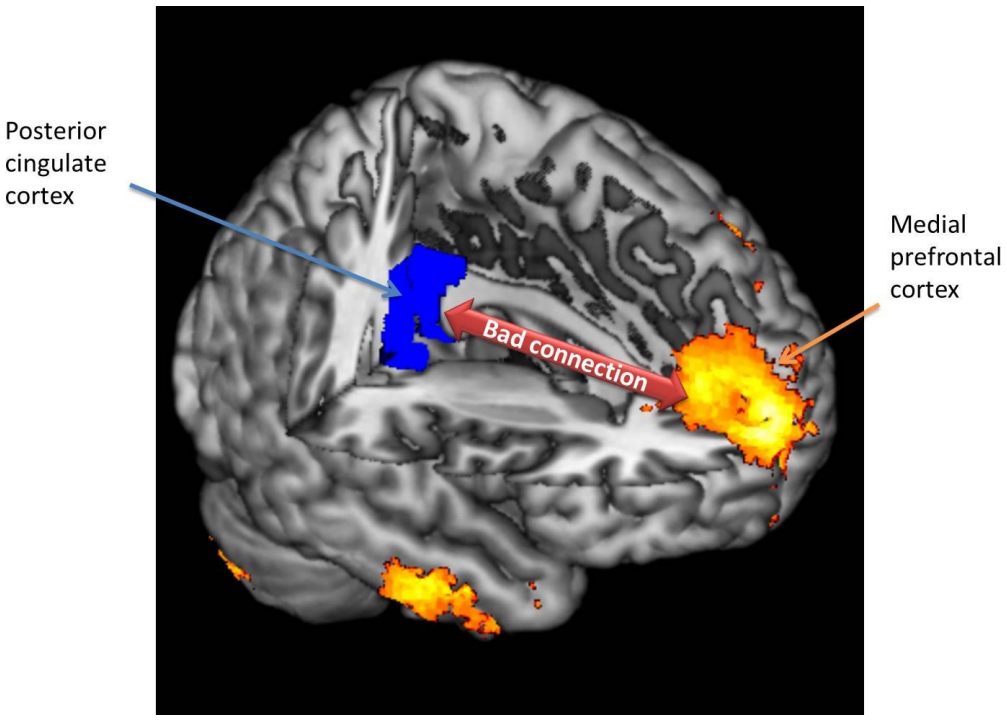
In this study, the researchers focused on the brain abnormalities responsible for the loss of consciousness observed during coma. They compared the activity of the brain at rest in 27 patients in this state, and of control subjects of the same age, using functional magnetic resonance imaging recordings.

Two regions of the brain no longer communicate with each other.

The scientists particularly analysed communications between the brain as a whole and one structure located at the back of the brain known as the posteromedial cortex (PMC). Activity

in this key region is reduced during sleep or anaesthesia. This structure is made up of two areas that the researchers studied (the precuneus and the posterior cingulate cortex)

A major loss of communication between the PMC and the anterior part of the brain (medial frontal cortex, MFC), particularly at the level of the posterior cingulate cortex, is seen in all comatose patients. This bad connection is present regardless of the mechanism responsible (head trauma or cardiac arrest with subsequent recovery). This observation suggests a major role for the interaction between these two structures in the emergence of consciousness in humans.



3D representation of the brain and areas involved
(posterior cingulate cortex in blue, medial frontal cortex in yellow)
© Inserm Unit 825

The team went further, and evaluated the extent to which this connection becomes altered with time. The researchers at Inserm compared recordings a few days after the brain insult and onset of coma with the neurological profiles of the patients three months later. It turns out that patient recovery is closely associated with the degree of involvement of this connection.

"Patients who are going to recover consciousness show levels of connections comparable to those found in healthy subjects. Conversely, a reduction in communication between the two areas predicts an unfavourable progression towards a vegetative state, or minimally conscious state," explain Stein Silva and Patrice Péran, who made this discovery.

These results constitute an important step in understanding the emergence of conscious perception of the outside world. They are promising, since neurologists might use this parameter to form a prognosis and develop treatment plans for comatose patients. However, research must be continued in order to decipher the mechanisms underlying coma, which are still poorly known.

Sources

Disruption of posteromedial large-scale neural communication predicts recovery from coma

Stein Silva (MD, PhD)[1,2,3], Francesco de Pasquale (PhD)[4,5], Corine Vuillaume (MD)[2,3], Beatrice Riu (MD)[1,2], Isabelle Loubinoux (PhD)[3], Thomas Geeraerts (MD, PhD)[2], Thierry Seguin (MD)[2], Vincent Bounes (MD, PhD)[6], Olivier Fourcade (MD, PhD)[2], Jean-Francois Demonet (MD, PhD)[7], Patrice Péran (PhD)[3].

1. Critical Care Unit. University Teaching Hospital of Purpan, Place du Dr Baylac, F-31059 Toulouse Cedex 9, France.
2. Critical Care and Anaesthesiology Department; University Teaching Hospital of Purpan , Place du Dr Baylac, F-31059 Toulouse Cedex 9, France.
3. INSERM U825. CHU Purpan, Place du Dr Baylac, F-31059 Toulouse Cedex 9, France.
4. Department of Radiology, Santa Lucia Foundation, Rome, Italy.
5. ITAB, Department of Neuroscience Imaging and Clinical Science, G. D'Annunzio University, Chieti, Italy.
6. SAMU 31. University Teaching Hospital of Purpan, Place du Dr Baylac, F-31059 Toulouse Cedex 9, France.
7. Leenaards Memory Center, Department of Clinical Neuroscience CHUV & University of Lausanne, Switzerland.

Neurology, 11 November 2015

Inserm investigator contacts

Stein Silva
Inserm Unit 825, "Brain imaging and neurological handicaps," Toulouse
05 62 74 62 10
silvastein@me.com

Patrice Péran
Inserm Unit 825, "Brain imaging and neurological handicaps," Toulouse

Press contact

Juliette Hardy
01 44 23 60 98
presse@inserm.fr

Access the Inserm press room