Medical Xpress

Brain activity during cardiac arrest

March 23 2015

Credit: AI-generated image (disclaimer)

All over the world, researchers are trying to solve an age-old mystery: What happens in the brain when the heart stops? With the support of the Austrian Science Fund FWF, medical experts from Vienna are participating in an international study that looks into memory processes during cardiac arrest.

How do we learn languages, how do feelings arise and what happens

while we sleep? State-of-the-art methods of brain research are able to provide answers to many of these highly complex issues. As scientists get better in explaining the way the brain works, important advances in treating neurological diseases such as sleeping disorders, migraines, apoplectic fits or dementia are made. Yet many questions remain unanswered and some give rise to controversy when talking about cognitive processes in the context of hard-to-define notions such as perception, consciousness or awareness.

Solving big mysteries

A research project funded by the Austrian Science Fund FWF is now set to provide scientific insights into one of these still unsolved mysteries: what goes on in the brain of people who are on the brink of death due to cardiac arrest and have memories of the time when their heart had stopped after resuscitation? Although a very rare occurrence, such experiences are reported from time to time. From a scientific point of view they are hard to explain, since electrical activity in the brain ceases seconds after the blood supply is interrupted – or does it? Scientists are still at a loss, but project head Roland Beisteiner is convinced that there are explanations for such events. "Although no comprehensive evidence of brain activity during cardiopulmonary resuscitation (CPR) has been found so far, this doesn't mean that it doesn't exist", observes the neurologist from the Medical University of Vienna and explains that an increasing amount of data, for instance from coma patients or the realm of anesthesia, points to the fact that the brain has great capacities for regeneration and information processing invisible to outside observers.

Collecting brain wave data

"We need as much physiological data as we can get and better control of what happens during CPR", says Beisteiner. Together with the neuro-

scientist Michael Berger and the emergency physician Fritz Sterz, he is going to collect such data for the first time in the ongoing international AWARE study, which is coordinated by New-York based emergency physician Sam Parnia. Austrian researchers were previously involved in AWARE ("AWAreness during REsuscitation") by evaluating questionnaires from patients "pulled back to life". In a subsequent step, emergency rooms of medical centers in the US, UK and Austria will be equipped with sensors to register blood flow and electrical activities in the frontal lobe. Researchers know from animal testing that brain activity declines rapidly upon cardiac arrest, but still remains at measurable levels for about 30 seconds. A recent study conducted in the USA even suggests that the brain may shift into something like a state of alert for this period and show signs of increased cognitive activity. This might explain why individual patients have experiences that feel very "real" to them during what is assumed to be a state of unconsciousness. There are also explanations for the even more rarely reported "out-of-body experiences", since visual-spatial perception can be manipulated, as has been demonstrated by experiments conducted by the Swiss neurologist Olaf Blanke. "Blanke's experiments show that we can manipulate the feeling of mind and body being a single unit", says Beisteiner. "The brain seems to have a predisposition for disruption of this unity of space and body, and hence the sensation of leaving one's body may arise", observes the neurologist.

Important fundamental research

The three-year FWF project "Gedächtnisprozesse bei Herzstillstand-PatientInnen" (2015–2018, Memory processes in cardiac-arrest patients) is not only designed to supply scientific facts for the discussion of a controversial topic, but is also expected to lead to improvements in the technical aspects of resuscitation. "We need this research to understand what the brain can do. Above all, it is important for physicians to know whether patients perceive things even if one cannot tell that from the

outside", emphasizes neurologist Beisteiner.

Roland Beisteiner is a specialist in neurology and psychiatry at the Department of Neurology at the Medical University of Vienna. His research investigates the functions of the human brain with a focus on imaging techniques, and he is an expert in the area of clinical functional magnetic resonance tomography (fMRT).

More information: "AWARE—AWAreness during REsuscitation—A prospective study." DOI: dx.doi.org/10.1016/j.resuscitation.2014.09.004

Provided by Austrian Science Fund (FWF)