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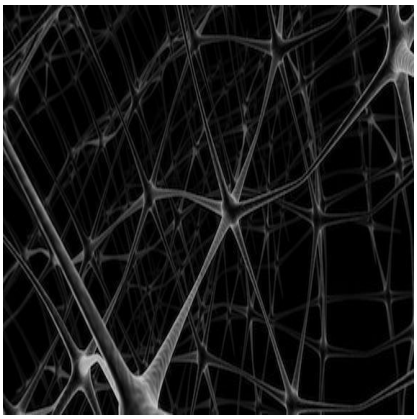
Research Finds Amended Brain Connections in Epilepsy Patients



A new study, available online in the journal 'Radiology', published its findings on the latest research on epilepsy, since the most frequent type of this condition causes abnormal, widespread connections in patients' brains which could provide indicators towards detection and treatment.

Seizures emanating from the temporal lobes, situated right above the ear on each side of the brain, are characteristic in temporal lobe epilepsy. Formerly it was believed that this condition was related to isolated structure injuries within the temporal lobe, such as the hippocampus. Recent research however, has involved the default mode network (DMN), consisting of a number of hubs, which are more active during a body's resting state. More specifically, the DMN is the collection of brain areas activated during task-free introspection and deactivated during goal-directed behavior.

In order to investigate further, the team of researchers conducted diffusion tensor imaging on a study group. This type of imaging is of the MRI kind, capable of tracking the movement, or diffusion, of water in the brain's white matter, the nerve fibers that transmit signals throughout the brain.

24 patients, diagnosed with left temporal lobe epilepsy and scheduled for surgical removal of the seizure-emanating site, made up the study group. Researchers evaluated them against 24 healthy controls, utilising an MRI protocol dedicated to finding white matter tracts with diffusion imaging at high resolution. The resulting data analysis was conducted with a new technique able to identify and quantify structural brain connections.

In comparison to the healthy controls, left temporal lobe epilepsy patients showed a decline in long-range connectivity of 22% to 45% among areas of the DMN.

Steven M. Stufflebeam, M.D., from the Athinoula A. Martinos Center for Biomedical Imaging at Boston's Massachusetts General Hospital explained that by using diffusion MRI, the team was in a position to detect amendments in the structural connectivity beyond the medial temporal lobe, specifically in the default mode network.

Additionally to the lower long-range connectivity, an 85% to 270% increase in local connectivity within and beyond the DMN was exhibited in the epileptic patients, leading the researchers to believe that this may be an adaptation to the loss of the long-range connections.

The results are supported by prior functional MRI studies, as they have demonstrated decreased functional connectivity in DMN areas in temporal lobe epilepsy. What is uncertain however, is whether the functional changes were caused by the structural changes, or whether it was the other way around.

Dr. Stufflebeam believes it could potentially be a breakdown of myelin (which is the insulation of neurons) which causes a slowdown in the propagation of information, however this was not confirmed. He concluded that the long-term research goal was to evaluate whether diffusion studies could predict which patients would respond to surgery and which would not.

It is planned to continue this research, with Dr. Stufflebeam and colleagues using structural and functional MRI with electroencephalography and magnetoencephalography to track diffusion changes and look at real-time brain activity.

The epilepsy study is part of the Human Connectome Project, funded by the National Institutes of Health and aimed at studying connectomics, or the functional and structural connections in the brain through the use of neuroimaging techniques. Matthew N. DeSalvo, M.D., a colleague of Dr. Dr. Stufflebeam, initiated the study as a medical student assisted by a 2013 Research Medical Student Grant from the Radiological Society of North America (RSNA).

Source: Radiological Society of North America

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