Computer model could hold key to personalized epilepsy treatment

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A computer model that identifies the parts of a person's brain responsible for epileptic seizures could be used to design personalised surgical procedures, researchers say.

Scientists at Newcastle University have used brain scans from patients with the most common type of epilepsy, temporal lobe epilepsy (TLE), and computer modelling techniques to look at the brain as an example of a computer network. By simulating brain activity within this network, they successfully identified regions that were more prone to seizures.

The research has been published in *PLOS Computational Biology*, and is believed to be the first study to combine computational modelling of brain dynamics with patient-specific MRI data from individuals with TLE.

The research team simulated surgery by removing sections of the network that corresponded to the parts of the brain most commonly removed. They also ran individual patient simulations removing the most seizure-prone regions for each person. By mimicking seizures before and after surgery, they found that patient-specific 'surgery' showed, in every case, a significant improvement compared to the currently used clinical procedure.

Dr Peter Taylor, a researcher at the School of Computing Science, Newcastle University, co-led the study. He said: "This research may help to explain why surgery is so often unsuccessful, as this work predicts that the areas most commonly removed in surgery are not always involved in starting and spreading seizures."

"It also takes us a step further towards rectifying the problem, as identifying the most seizure prone areas on an individual basis has the potential to show when the usual surgery procedures may not work for a patient."

The team say further research is needed to check the model's predictions against patient-specific surgical outcomes. Professor Marcus Kaiser, Professor of Neuroinformatics at Newcastle University, said: "The next steps are to compare the computationally predicted outcomes with the actual surgery outcomes in individual patients and to investigate how alternative surgery targets can be included in the future treatment."

Frances Hutchings, a PhD student who carried out the work, added: "Removal of brain tissue is often the final option for treatment of temporal lobe epilepsy but we know that it is not always effective. This model could assist surgeons in targeting surgical procedures more effectively and help people with epilepsy lead a more normal life."

More information: *PLOS Computational Biology*, journals.plos.org/ploscompbiol … journal.pcbi.1004642

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