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New brain imaging method shows promise for epilepsy

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With 25 percent of his brain already gone, Clint Galster sat alone in a vaultlike room as doctors tried to figure out whether even more brain tissue could be taken out.

The solitary enclosure is the size of a small bedroom, but it weighs 7 tons. It's lined with special metal walls thick enough to hide kryptonite from Superman.

The door was closed and a long steel lever was pulled down, sealing Galster inside, nestled in a large white machine with a reclining seat and a headpiece that looks like it might dry hair at a salon.

Over more than an hour, Froedtert Hospital personnel used the device to monitor and record the inner workings of his brain.

If Galster was lucky, the $3 million machine would find areas of abnormal electrical activity that later could be removed safely by a surgeon. Not so lucky, and the 34-year-old would continue to be plagued by seizures.

His seizures are not under control, despite taking four epilepsy drugs a day and undergoing surgery eight years ago to implant a nerve stimulator under his collarbone, as well as a brain operation as a teenager.

Now Galster is on the forefront of a technology that might make it easier for people with epilepsy and their doctors to decide whether they can

benefit from brain surgery.

Magnetoencephalography, or MEG, is an emerging method that is being used in a variety of studies, ranging from finding better ways to diagnose Alzheimer's disease to looking at what happens in the brains of people who stutter or suffer from Tourette syndrome.

In the 1995 sci-fi thriller "Strange Days," MEG-like technology recorded the electrical activity of a person's brain, which then could be used by someone else to re-experience those thoughts and feelings.

"Our technology is not that advanced," said Frederick Langheim, a neuroscientist and psychiatry resident at the University of Wisconsin-Madison.

Still, research suggests that whole-brain MEG recordings might someday be used to categorize people as healthy or suffering from conditions such as multiple sclerosis, schizophrenia, Alzheimer's or chronic alcoholism, said Langheim, who used MEG for his doctoral work on the dynamics of brain networks.

But one of its most promising applications is epilepsy.

It is believed that many more people could benefit from surgery, but it is risky and expensive. Galster suffered a small stroke during his first brain operation at age 15 and has weakness on his left side.

Often in epilepsy cases, patients must undergo pre-surgery in which part of the skull is removed and electrodes temporarily are placed on the surface of the brain to look for seizure-producing areas.

It is hoped that MEG will eliminate the need for the surgical diagnosis in many patients, but that still needs to be proved, said Susumu Sato, a

physician and researcher with the National Institute of Neurological Disorders and Stroke, part of the National Institutes of Health.

Such preliminary surgeries can cost tens of thousands of dollars, compared with about $5,000 for a MEG scan, Sato said. But right now, most insurance companies won't pay for MEG scans, he said.

"It is very exciting technology," Sato said.

The Froedtert device, paid for by an anonymous donor, is one of about 30 in the United States.

The technique looks for electrical currents and the magnetic fields produced by brain cells. All electrical currents produce magnetic fields, but with brain cells, magnetic activity is minuscule -- it has been compared to trying to hear an ant's footsteps at a rock concert.

MEG readings must be done in a room shielded from outside magnetic fields, requiring walls lined with a special metal that are 7 inches thick, said Sylvain Baillet, scientific director of Froedtert's MEG program and an associate professor of neurology at the Medical College of Wisconsin.

In addition, liquid helium at absolute zero (minus 273 degrees Celsius) is used to cool the inside of the machine, he said.

One of the advantages to MEG over other imaging techniques is that it can monitor brain activity over a period of milliseconds, as opposed to a second or more with magnetic resonance imaging. And MEG looks at electrical and magnetic activity of brain cells, while MRIs measure blood flow and oxygen used by brain cells.

That's important because with epileptic seizures, the abnormal activity of a group of neurons may fire in unison, producing a synchronized spike

that can be picked up by MEG.

The trick is detecting those spots in the brain and determining whether they can be removed without causing damage to other important areas such as those controlling movement or vision.

Last week, Galster, of Waukesha, Wis., got the results of his MEG scan.

The scan showed three areas that are potential surgery sites, including a crucial one near the site of his first surgery.

More importantly, it showed there was enough of a margin between those sites and areas that control Galster's movement so that surgery could be done.

"It's reasonable to think about doing a second set of operations in an attempt to get better control of his epilepsy," said Wade Mueller, a Froedtert brain surgeon and professor of neurosurgery at the Medical College.

The decision now is up to Galster, who said he is going to need time to decide if he wants to risk surgery again.

He continues to have weakness on his left side from the stroke during his first surgery 20 years ago. But that surgery dramatically improved his epilepsy, reducing his seizures from hundreds a day to a few a week.

Still, Galster, who works part time on a cleaning crew, can't drive.

With a second operation would come up to a 5 percent risk of infection, bleeding or another stroke. And those complications could lead to speech, vision or memory problems; personality changes; more weakness or paralysis; coma; or death.

"It's a crapshoot," Galster said. "I don't really know if I want to go through the whole surgery again or just leave it as it is."

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