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NEWS

RSNA Press Release

Functional MRI Enables Noninvasive Evaluation of Epilepsy Patients

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At A Glance

- fMRI gives surgeons a roadmap of the brain, and is the first noninvasive method of preoperative functional assessment of patients with seizure disorder.
- fMRI depicts critical brain functions and their proximity to the seizure focus.
- In the study, fMRI results altered overall surgical plans in 42 percent of patients.
- Seizure disorder affects 2.5 million Americans.

OAK BROOK, Ill.-Functional magnetic resonance imaging (fMRI) of the brain reduces the need for invasive testing of seizure disorder patients being considered for surgical treatment, according to a study published in the July issue of the journal *Radiology*.

"fMRI gives the surgical team an important roadmap of the brain function without contrast injections or invasive tests," said the study's lead author, L. Santiago Medina, M.D., M.P.H., co-director of neuroradiology and director of the Health Outcomes, Policy and Economics Center at Miami Children's Hospital. "This imaging technology is a powerful tool that improves surgical decision making in patients being considered for seizure surgery."

Dr. Medina's study evaluated the effect of fMRI results on the diagnostic work-up and treatment planning of 60 consecutive seizure disorder patients, including 33 male and 27 female patients. The fMRI findings helped five patients avoid additional surgery and altered the extent of surgery in four others.

A seizure is an outward sign of a malfunction in the electrical activity of the brain. Seizures that occur more than once without special cause are called seizure disorder or epilepsy. According to the Epilepsy Foundation of America, 2.5 million Americans have been diagnosed with epilepsy.

Brain surgery has proven to be an effective treatment for patients with seizure disorders who do not respond to medication. The surgical treatment involves resecting, or cutting away, brain tissue that contains a seizure focus—the location in the brain where the seizures originate. Before resection surgery is performed, the treatment team uses diagnostic tests to help determine the proximity of a seizure focus to vital areas of brain function and to provide a map of the area.

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Until recently, the Wada test and electrical cortical mapping—both invasive, costly tests that require large medical teams—were the only methods for identifying these critical areas. fMRI, which uses radio waves and a strong magnetic field, is a non-invasive test capable of identifying the location of critical brain functions that could be affected by the location of the seizure focus.

Based on fMRI results, five patients in Dr. Medina's study avoided a two-stage surgery with extra-operative direct electrical stimulation mapping and instead received a one-stage resection surgery. The extent of surgical resection was altered in another four patients, because fMRI images identified critical areas of the brain close to the seizure focus.

Other changes in patient care based on fMRI results included:

- The team altered patient and family counseling in 58 percent of patients;
- Intraoperative mapping was altered in 52 percent of patients;
- Overall surgical plans were altered in 42 percent of patients;
- 63 percent of patients were able to avoid further studies, including the Wada test.

"When the medical team reviewed functional MR images of the brain, they significantly changed the patient's diagnostic and treatment plans," said neurologist Byron Bernal, M.D., co-author of the study. "With fMRI, the physician, patient and family have more information about important critical areas of brain function, helping them make more informed decisions."

Of the study's 60 patients, 32 were not candidates for surgery or refused surgical treatment. Of the 28 patients who proceeded with surgery, 17 were seizure-free following the resection, and eight had a 50 percent to 90 percent reduction in seizures. Three of the surgical patients experienced less than a 50 percent reduction in seizures at six-month follow-up.

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"Seizure Disorder: Functional MR Imaging for Diagnostic Evaluation and Surgical Treatment-Prospective Study." Catalina Dunoyer, M.D., Luisa Cervantes, M.D., Marelis Rodriguez, Esperanza Pacheco, M.D., Prasanna Jayakar, M.D., Ph.D., Glenn Morrison, M.D., John Ragheb, M.D., and Nolan R. Altman, M.D., collaborated with Drs. Medina and Bernal on this paper.

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