

**RESEARCH/PROJECT NAME:** Investigations of Cortical Malformations in Epilepsy with Ultrahigh Field MRI

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**PROJECT SUMMARY:** Malformations of cortical development (MCDs) are a common cause of medication-resistant seizures in partial epilepsies. The MCDs are areas of the brain that do not form normally before birth, due to various genetic and non-genetic conditions. Often seizures start in the areas of an MCD, and epilepsy surgery can be effective in safely removing some types of MCDs in order to control seizures.

Currently 3 Tesla magnetic resonance imaging (MRI) provides the highest quality of brain structural images that are clinically available. Unfortunately 3 T MRI often misses small focal cortical dysplasias (FCDs), and these are among the MCDs that are most likely to cause medication-resistant seizures that could be controlled by epilepsy surgery. Brain imaging with 7 Tesla MRI appears to provide sharper images of the brain than can be achieved with 3 T MRI, but 7 T MRI is relatively new and has not been approved for general use under Federal regulations. Our research group studied whether research 7 T MRI can give better information on MCDs than clinical 3 T MRI provides.

We looked at 18 partial epilepsy patients who had various types of MCDs on their clinical 3 T MRI scans. In each of these patients the research 7 T MRI showed additional fine details of the malformations.

We also looked at 2 partial epilepsy patients who had no abnormalities that were found on their clinical 3 T MRI scans. In both of these patients the research 7 T MRI showed small FCDs in brain areas that fit with their EEG and other seizure information.

Improved brain imaging at 7 T may in the future be developed to improve the treatment of medication-resistant seizures, based on better planning of epilepsy surgery. Considerable research effort will be needed to reach this goal.

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