IMAGING TECHNIQUES SUCH AS DTI AND FMRI SHOULD BE EMPLOYED IN THE ROUTINE DIAGNOSIS OF PATIENTS WITH EPILEPSY

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The advantages of specialized MRI imaging techniques in patients with intractable epilepsy are well understood. Standard structural MRI may fail to detect epileptogenic lesions in as many as 50% of patients. Occasionally too, false positive results may be produced by overly sensitive sequences such as fluid attenuated inversion recovery (FLAIR). The additional data from specialized MRI such as diffusion tensor imaging (DTI), magnetization transfer and magnetic resonance spectroscopy may be very helpful in identifying and confirming localization of the epileptogenic zone. For example, magnetization transfer may identify subtle focal cortical dysplasia (FCD) not found by other means. Aniosotropy maps may be used to identify white mater fiber tracts to important to spare during surgery, such as optic tracts, or connections between Wernicke's and Broca's areas. Thin cut curvilinear reconstruction of high resolution images also may help to identify small regions of FCD. Functional MRI language activation studies have become a standard part of presurgical evaluation, and accumulating data from fMRI memory activation studies suggest that the intracarotid amytal test may no longer be needed in the majority of patients.

For patients who are not surgical candidates, adding additional specialized techniques to the standard anatomic imaging evaluation may be very valuable for several reasons. Some data suggest that imaging studies can help to determine whether patients will have a good response to antiepileptic drugs or eventually become refractory. Newer techniques may show abnormalities not detected by standard structural MRI that define the region of the 'dysfunctional zone' related to clinical co-morbidities. DTI may show extensive bilateral white matter abnormalities in TLE extend far beyond the epileptogenic temporal lobe. MRS may show bilateral regions of reduced NAA/CR+Choline; some reports suggest these may resolve after successful surgery. We have very little data on the factors that influence a transition from well-controlled to intractable epilepsy, as well as those that lead to the fluctuations in seizure control patients may experience over many years. Data acquired early in the course of epilepsy may be helpful to assess the effects of factors such as antiepileptic drugs, gender, and patient age on functional imaging studies, particularly if serial studies are done.

Serial functional studies would be very valuable in following the effect of seizures on functional anatomy and a patient's response to treatment. Data obtained early in a patient's course, before secondary effects of seizures have occurred, may be more valuable in studying 'epileptogenesis.'

Additional MRI sequences can be acquired in a reasonable time frame. A standard package of structural scans, including a three dimensional T1-weighted volume acquisition, T2, and FLAIR, takes approximately 10 minutes. fMRI language and memory sequences add about 5 minutes each. DTI would add an additional 8-10 minutes.

Our knowledge of the effects of seizure foci, as well as epilepsy in general, on the functional anatomy of language, memory, and psychiatric comorbidities of seizure disorders is limited, and based mainly on presurgical evaluation. We do not know how the progressive clinical impairment that can be observed in relation to specific seizure foci or epilepsy syndromes relates to changes in cortical function or fiber tract reorganiation. Studying patients early in their course may increase our knowledge of the evolution of epilepsy-related cerebral dysfunction, and eventually improve patient care. In order to achieve these goals it will be essential to pool imaging and clinical data across centers, and collaborate on sequence acquisition parameters. Image processing will be an important part of this effort.

References

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