EPILEPTOGENIC LOCALIZATION USING MAGNETIC SOURCE IMAGING AND INTRACRANIAL RECORDINGS

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Rationale:

Presurgical evaluation in the management and treatment of patients with epilepsy has been aimed at identifying areas of epileptogenic potential. Magnetic Source Imaging (MSI) provides a noninvasive assessment of these pathologic waveforms by identifying and localizing interictal spikes. Previously, this information was most accurately gained during the surgical treatment phase through intracranial recordings with the placement of subdural electrode arrays (SEA) and/or intraoperative electrocorticography (ECOG). This report provides correlation of data in patients who have undergone both procedures in the course of surgical intervention.

Methods:

27 patients diagnosed with chronic epilepsy and/or brain tumor underwent presurgical evaluation with magnetoencephalography (MEG) at the Minnesota Epilepsy Group, PA/United Hospital between November 2004-April 2006. Acquisition of MEG was performed on a 148-channel Magnes 2500 WH System (4D-Neuroimaging Inc, San Diego, CA). Spontaneous cerebral activity was recorded with the standard international 10-20 system EEG. Magnetic sources of interictal activity were modeled as single equivalent dipoles. The dipoles were superimposed onto 3D-SPGR MR images. Subsequent surgical evaluation was performed at United Hospital or Children's Hospitals and Clinics of Minnesota-St Paul, MN and included SEA and/or intracranial ECOG to identify interictal activity and ictal onset.

Results

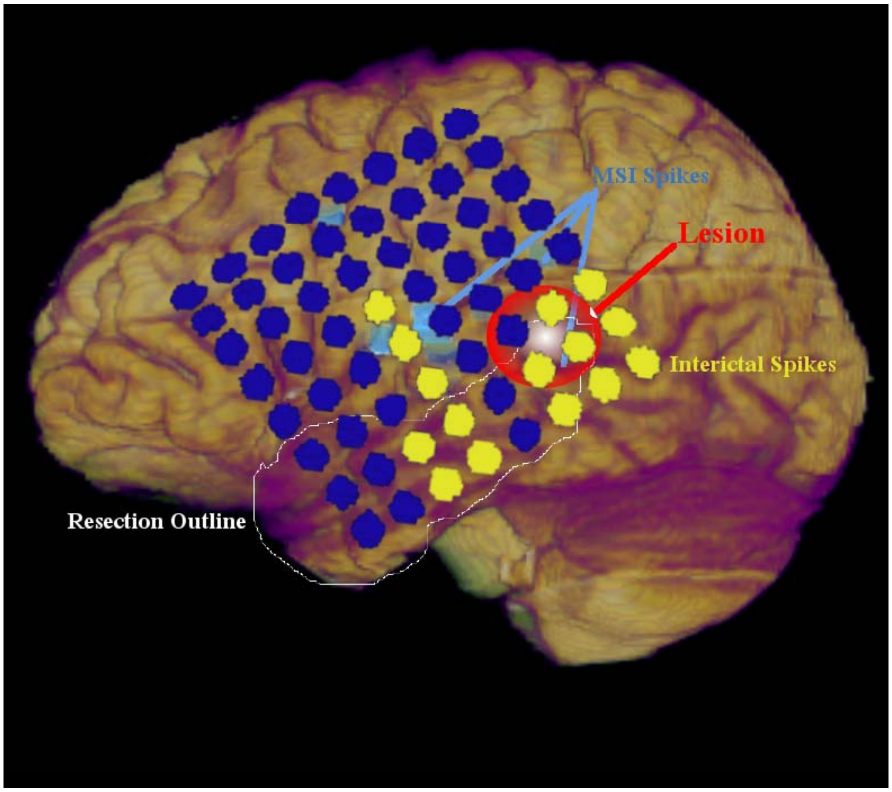
There were 15 females and 12 males aged 2yo to 52 yo in this group of patients. 17 of 27 patients yielded fully concordant results between MSI and intracranial recordings. In 7 cases MSI corroboration was limited due to the inability to completely provide sampling via SEA and/or ECOG from all areas in which independent interictal spikes in both left and right hemispheres had been identified during MSI studies. However, in these 7 cases MSI interictally active areas were confirmed with SEA and included in areas of resection. In the remaining 3 patients SEA identified additional areas of interictal activity not demonstrated on MSI. It is noted in 2 of these patients interictal and subsequent ictal activity was seen only after significant reduction in antiepileptic medications. The final patient was found to have frontal interictal activity on MSI; yet SEA revealed an additional mesial temporal focus.

Conclusion:

MSI accurately identified areas of interictal activity as confirmed with SEA or ECOG.1 MSI information gained non-invasively during presurgical evaluation may guide SEA placement and in selected patients will lead to a reduction of invasive procedures to identify areas of epileptogenesis.

Reference:

Knowlton RC, Elgavish R, Howell J, Blount J, Burneo JG, Faught E, Kankirawatana P, Riley K, Morawetz R, Worthingon J, Kuzniecky RI.,Magnetic source imaging versus intracranial electroencephalogram in epilepsy surgery: a prospective study. Annals Neurology, 2006 May; 59(5):835-42.



Virtual reconstructed 64 contact SEA generated from 3D-CT scan superimposed onto 3D-SPGR MRI with correlation of interictal spikes and resection outline. The patient was a 21 yo RH woman with dual pathology of mesial temporal sclerosis and a cortical tuber. The resection line was drawn to spare mapped language cortex.