MEG-guided surface coil imaging at 3 Tesla in patients with refractory epilepsy: preliminary results

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SUMMARY PURPOSE: Patients with refractory epilepsy in whom the epileptogenic zone cannot be precisely identified using the currently available presurgical evaluation tools are not likely to undergo resective surgery and remain prone to uncontrolled seizures. The aim of this study is to assess the added value of surface coil imaging at 3 Tesla (3T SCI) guided by magnetoencephalography (MEG) with regard to their potential to locate the epileptogenic zone in order to increase the number of patients eligible for resective surgery.

METHODS: So far, fifteen patients with drug-resistant epilepsy who were included in the presurgical evaluation protocol and in whom the MEG exam had shown a (non-mesiotemporal) dipole cluster indicating the potential epileptogenic zone, subsequently underwent a surface coil MRI exam at 3 Tesla. Patients were scanned on a Siemens Trio system using a 4-channel Bitemporal Phased Array surface coil (NMSC-003, Nova Medical). 3D MPRAGE (0,9 mm^3, TR 2530 ms, TE 2.6 ms) were acquired as well as axial and coronal TSE T_2-weighted images (slice thickness 2 mm, in plane 0.37 mm^2, TR 6000 ms, TE 74 ms). Surface coil positioning was determined by the location of the MEG dipole cluster. On previous epilepsy optimized MRI at 3T, patients either had a negative MRI (n = 4) or showed a possibly epileptogenic cortical lesion (n = 11).

RESULTS: In the patient group with previously known lesions on standard 3T MRI, MEG confirmed dipole clustering in the vicinity of these lesions and 3T SCI provided improved delineation of the lesion, resulting in higher diagnostic confidence. In the patient group with initially negative 3T MRI (for an example, see figure 1), 3T SCI showed a previously undiagnosed lesion in close proximity to the dipole cluster in three patients (75%). These lesions demonstrated imaging characteristics of small migration anomalies. One of these lesions could be detected retrospectively on standard optimized 3T MRI. The remaining patient of the latter group showed no structural anomalies on 3T SCI.

CONCLUSION: In patients with refractory epilepsy, surface coil imaging at 3T guided by MEG has shown an added value in the detection of lesions that were previously not visible or missed on 3T MRI, and demonstrated an improved delineation and electrophysiological validation of previously known lesions. Further research is needed in larger patient groups, especially in patients with previous negative MRI, to evaluate the exact added value of the combined techniques.

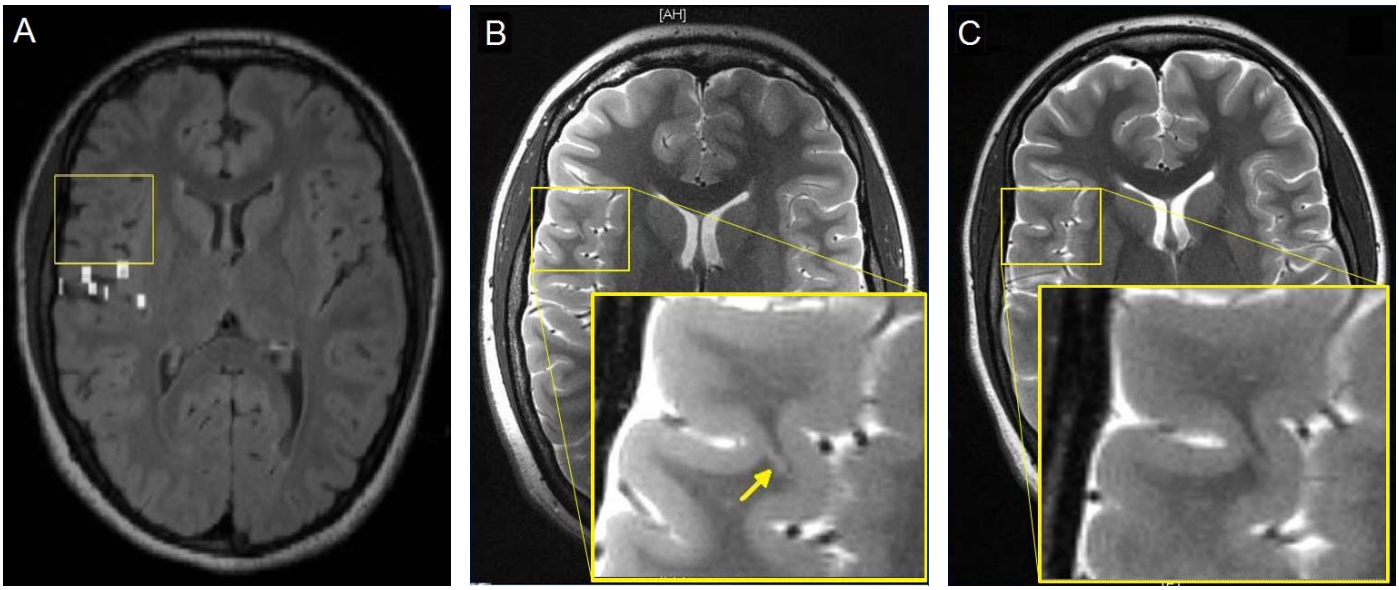

Fig. 1 Example of a patient with a negative epilepsy optimized MRI at 3 Tesla. (A) Axial FLAIR image co-registered with MEG dipole cluster (white squares) (B) T_2-weighted surface coil image in the same plane as (A) with the surface coil positioned near the brain region indicated by the dipole cluster. An anomaly was found at the junction between grey and white matter in proximity to the dipole cluster (arrow). (C) Previously acquired T_2-weighted image with optimized epilepsy protocol at 3 T in the same plane as (A). The anomaly shown in (B) is barely visible.