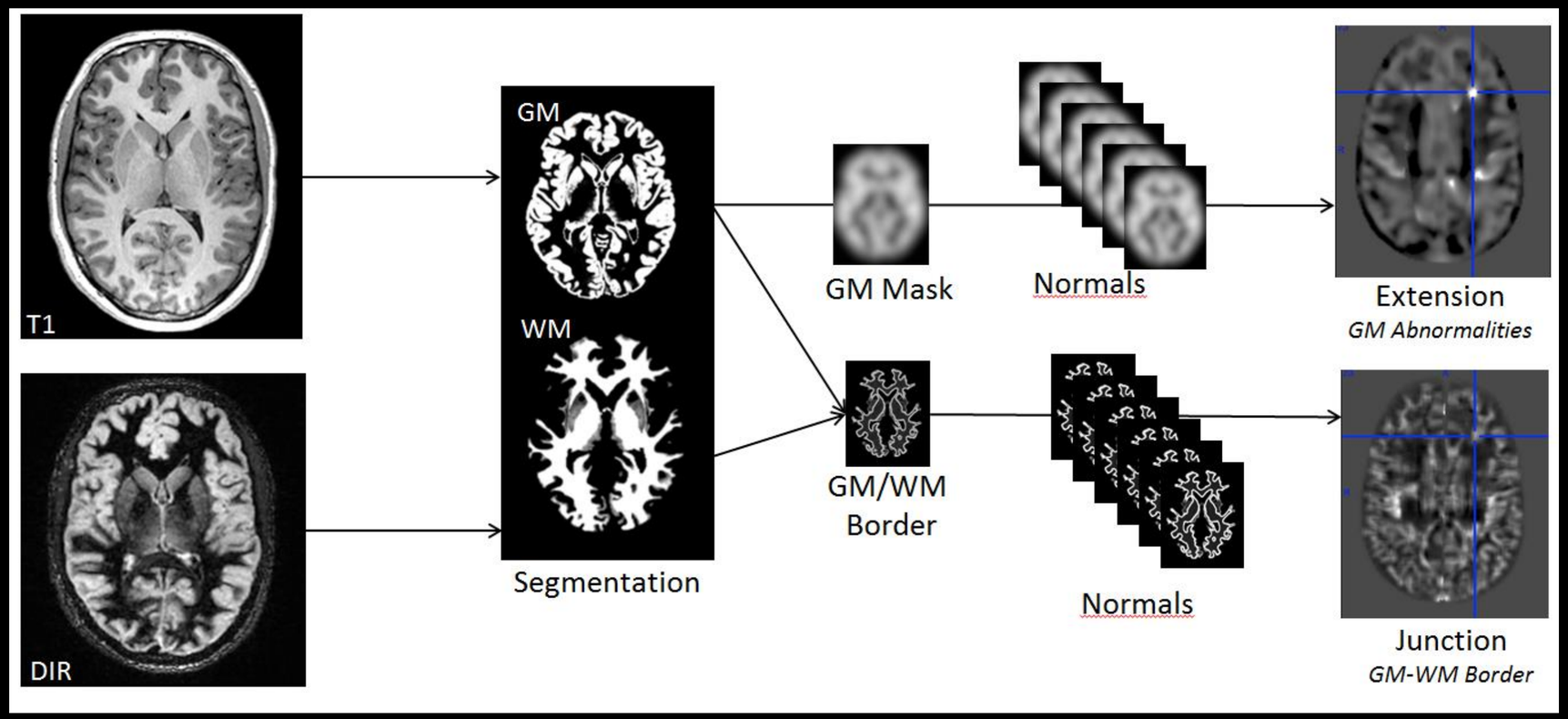
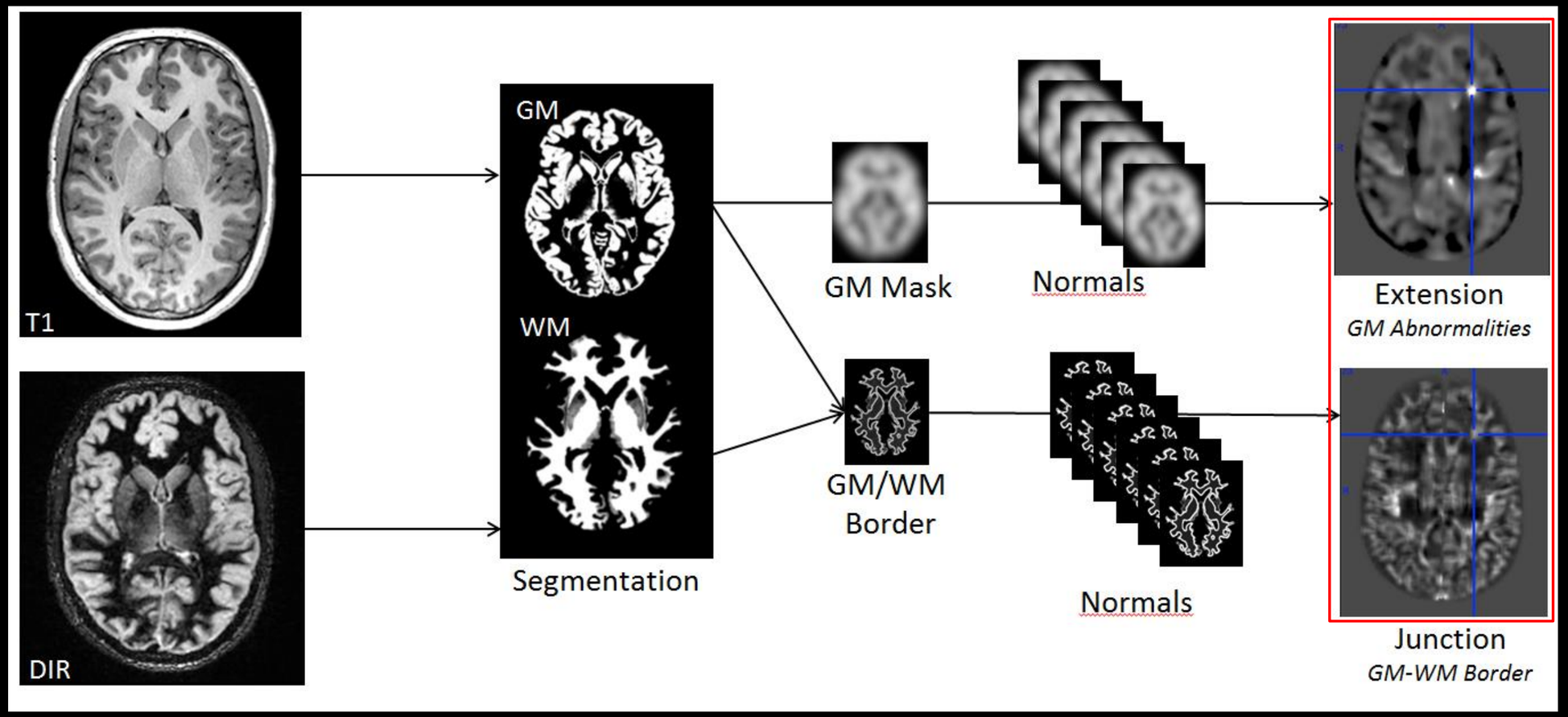
Materials and Methods

- Study Design: Retrospective review of patients who underwent MRI with DIR sequence as part of epilepsy protocol between 2012 -2019
- Diagnosis of FCD was either made on multimodality imaging review at surgical epilepsy conferences or pathology
- Automated MAP processing was implemented as shown

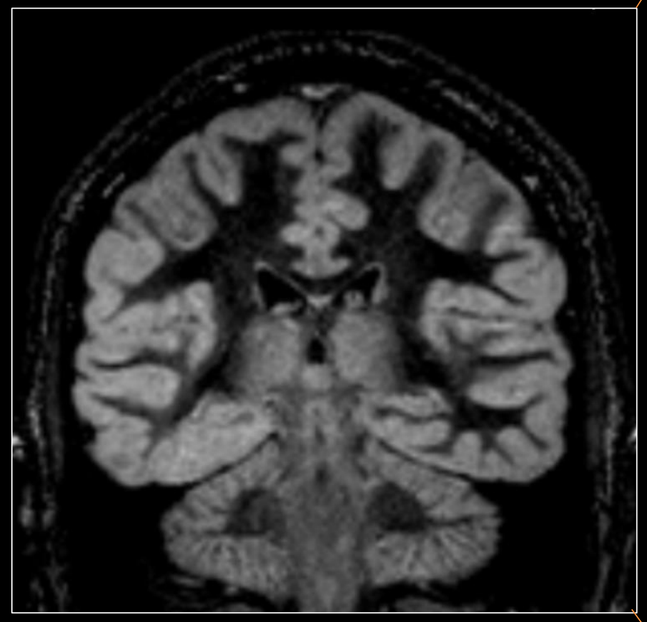


On a voxel-basis, means of segmented GM and GW/WM border maps derived from DIR from each patient were subtracted from maps of age-referenced healthy adult or pediatric controls and divided by standard deviation to generate z-score maps[6]



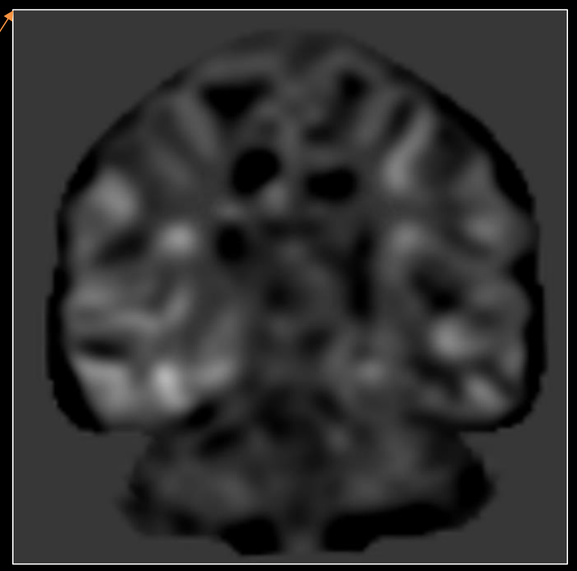
- Final z-score maps were labeled as MAP-extension (MAP-E) and MAP-junction (MAP-J), putatively identifying GM abnormalities and abnormal GM-WM junctions respectively
- These z-score maps were available on grayscale and were also displayed in color after overlaying on DIR images
- MAP-E was set with a display range for -2 to 8 SD and MAP-J was set with a display range -4 to 10 SD based on our prior experience with T1w MAPs [6]

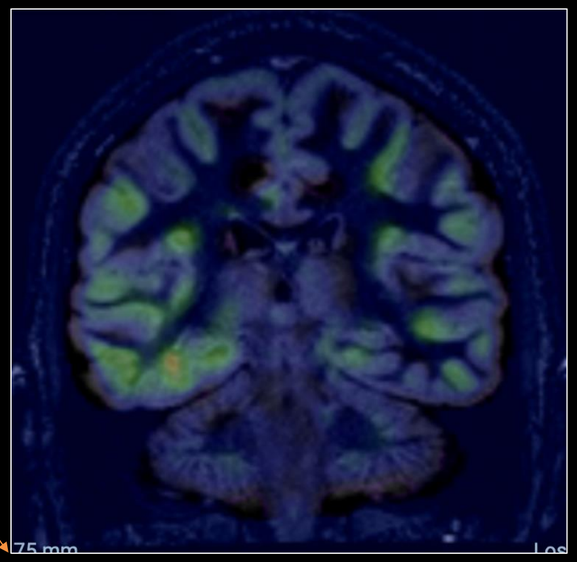
Example of MAP Output and Display



Acquired DIR image

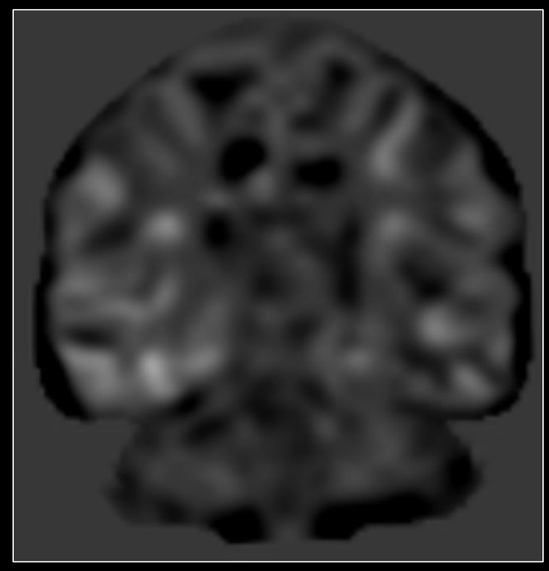
MAP-E Grayscale

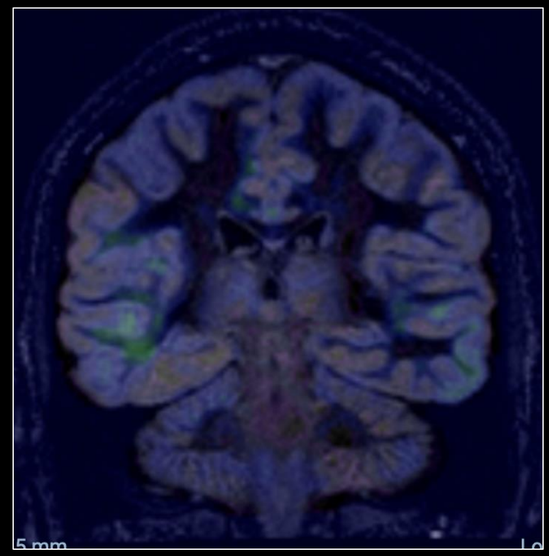




MAP-E overlaid on DIR with standard NIH scale color display

MAP-J Grayscale





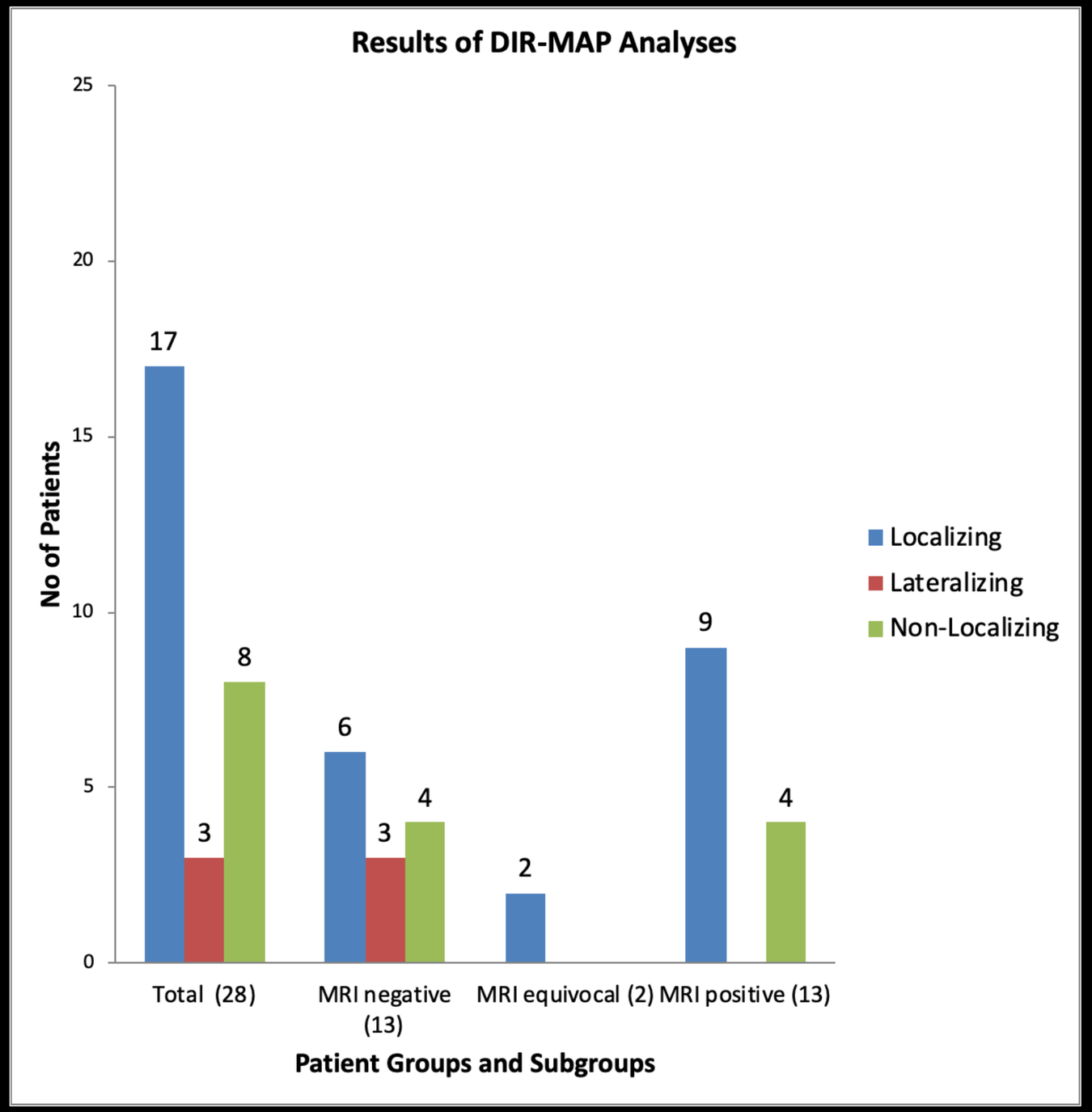
MAP-J overlaid on DIR with standard NIH scale color display

- Results of DIR-MAP Review

- In 15 cases with initial equivocal/negative MRI reads, DIR-MAP localized to FCD site in 8/15 (53%), lateralized in 3/15 (20%) and was non-localizing in 4/15 (27%)

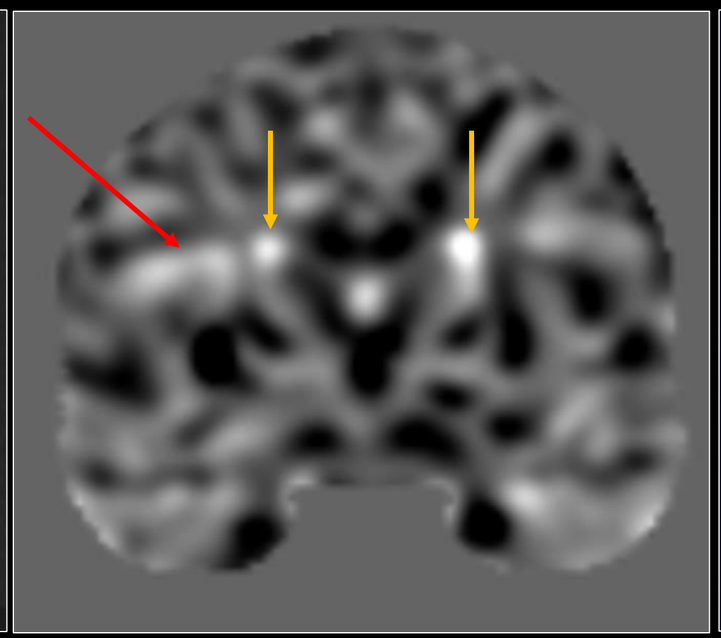
- Of 13 patients with initial positive MRI reads, DIR-MAP confirmed/co-localized to FCD in 9/13 (69%) and failed to localize to visible FCD in remaining 4/13 (31%)

- Overall, DIR-MAP was localizing in 17/28 (61%), lateralizing in 3/28 (11%) and non-localizing in 8/28 (28%)

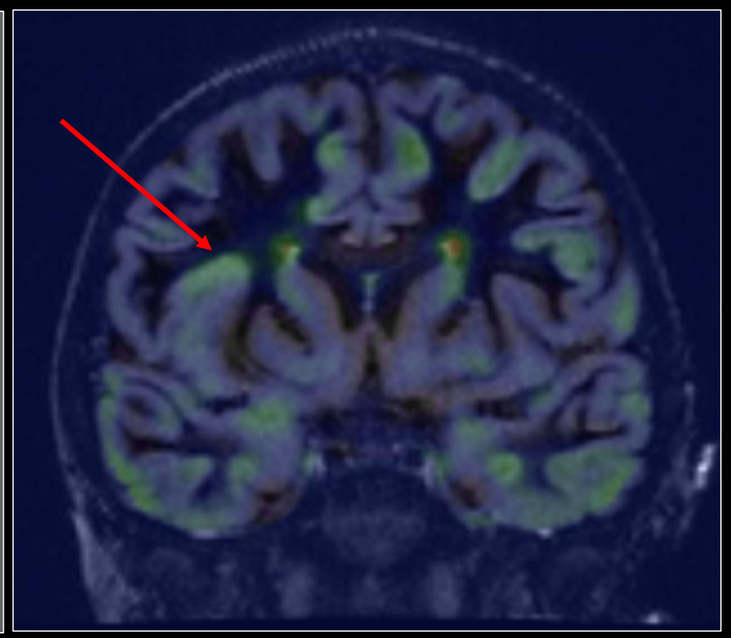


- Results of DIR-MAP Review
- In 17 patients in whom DIR-MAP was localizing, findings were more conspicuous on MAP-E in 13/17 (76.5%) and on MAP-J in 4/17(23.5%)
- Finding was more conspicuous on grayscale MAP in only one patient as compared to color overlay (shown below)

DIR sequence



MAP-E Grayscale

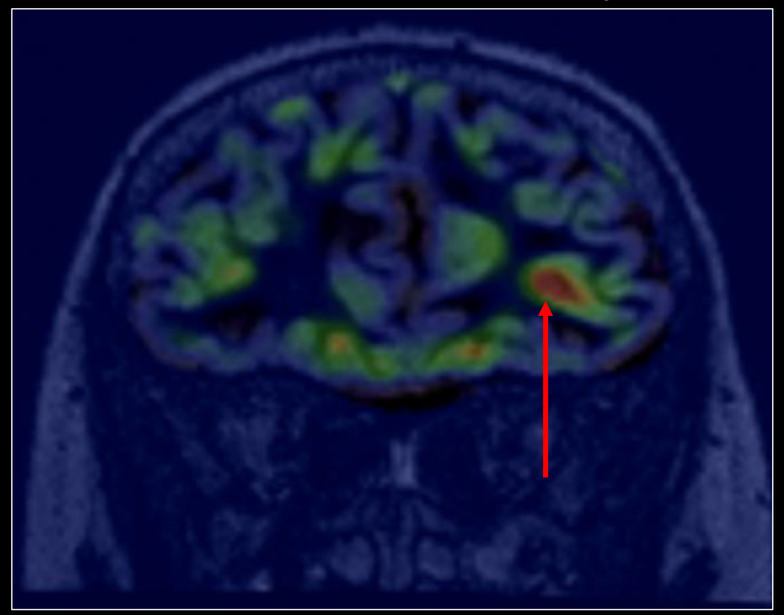


MAP-E Overlay

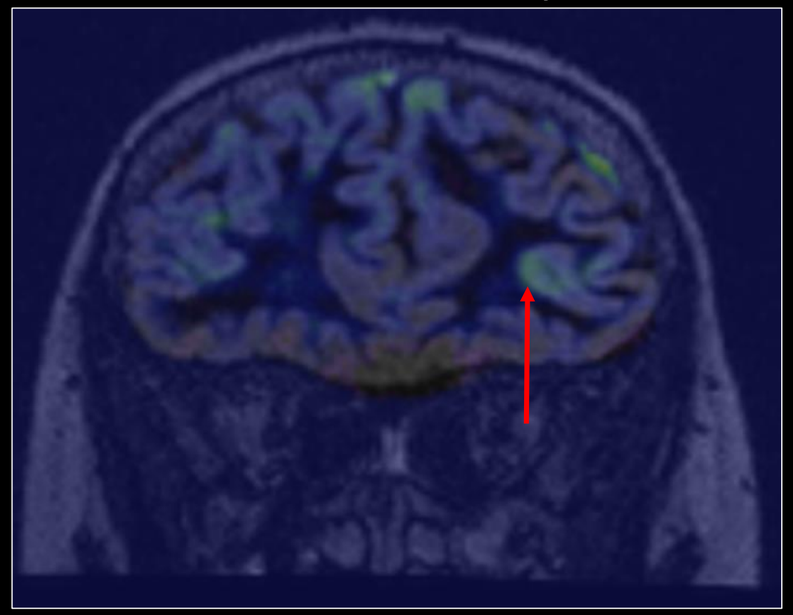
A 10 yo boy with medically intractable epilepsy. Initial 3T MRI was read negative. After PET/MRI, 7TMRI and SPECT correlation, cortical thickening was identified in right insula (arrow). This was confirmed as seizure onset zone on SEEG and patient underwent laser ablation. On DIR-MAP review, asymmetric bright focus was seen in right peri-insular region (arrows), was considered more conspicuous on grayscale MAP-E than on MAP-E overlay. Other periventricular bright spots (arrows) are known artifacts on MAP and were dismissed.

Example of MAP-E better than MAP-J

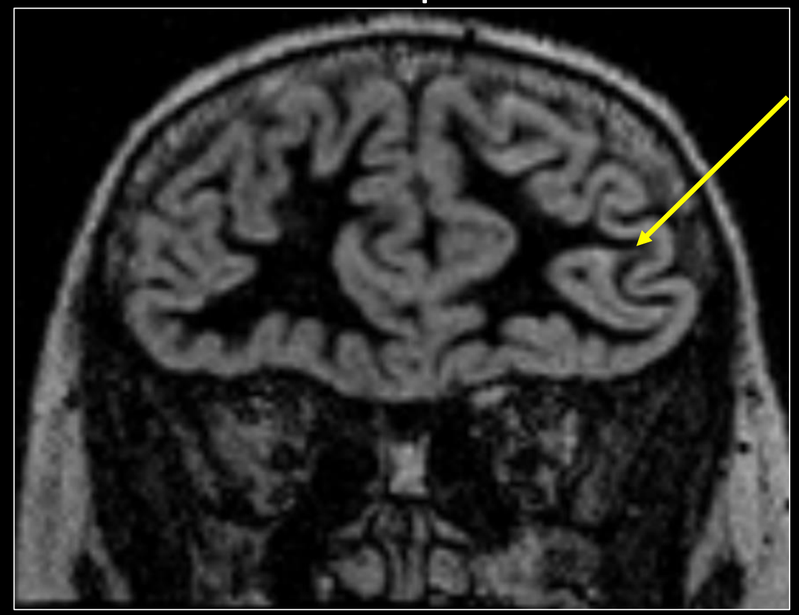
MAP-E Overlay



MAP-J Overlay



DIR sequence

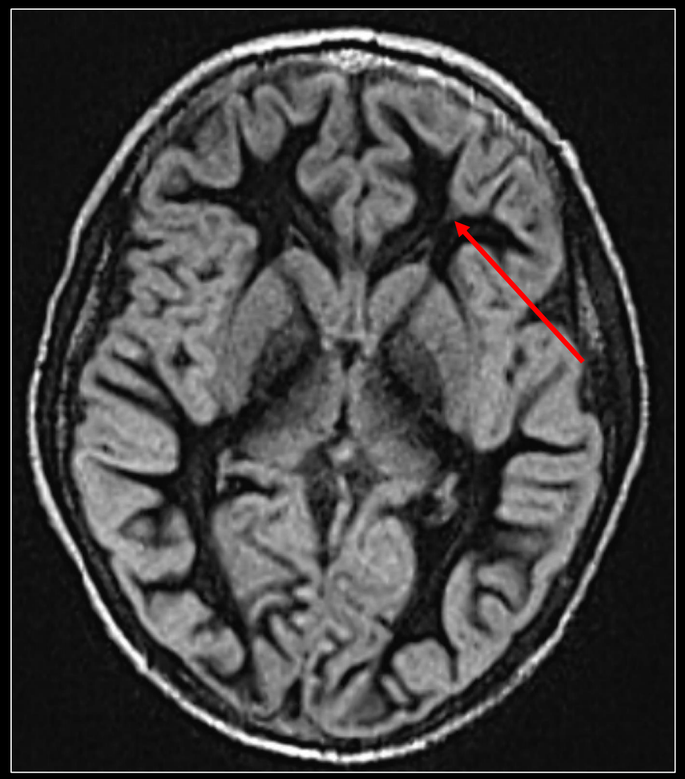


A 13 yo boy with medically intractable epilepsy and pathology proven Type 2B FCD after SEEG implantation and resection. Initial 3T MRI was read negative.

DIR MAP-E shows focal bright spot in inferior left frontal gyrus (arrow). MAP-J is not as conspicuous. Relook at DIR coronal image showed cortical thickening and subcortical white matter hyperintensity (arrow, circle). Axial DIR image also showed suggestion of transmantle sign (arrow)

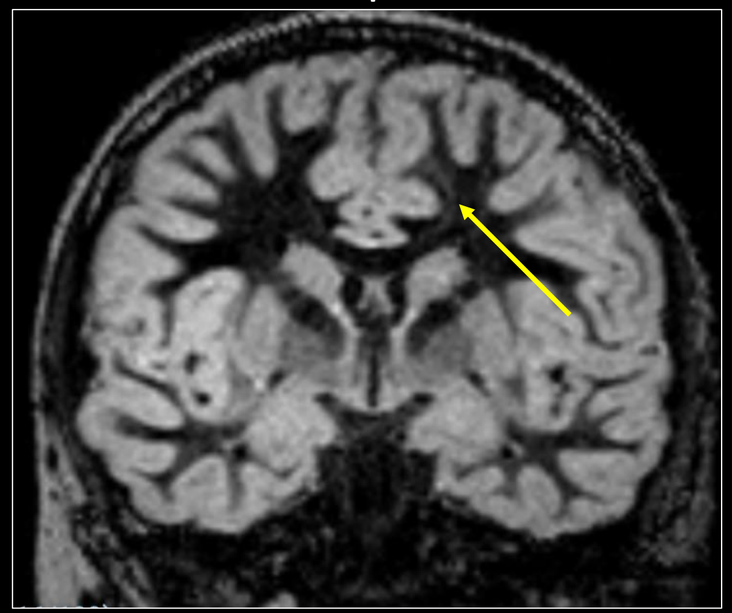
This region was confirmed as seizure onset zone on SEEG. Cortical resection was performed and pathology showed Type 2B FCD

Axial DIR

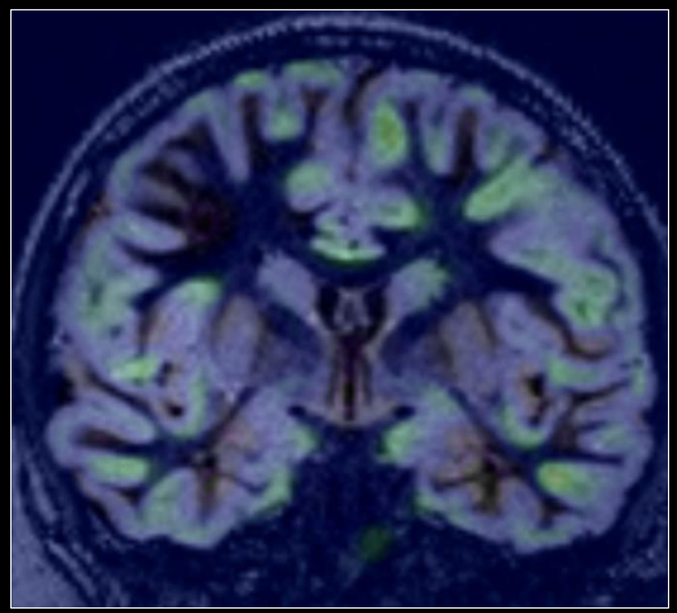


Example of MAP-J better than MAP-E

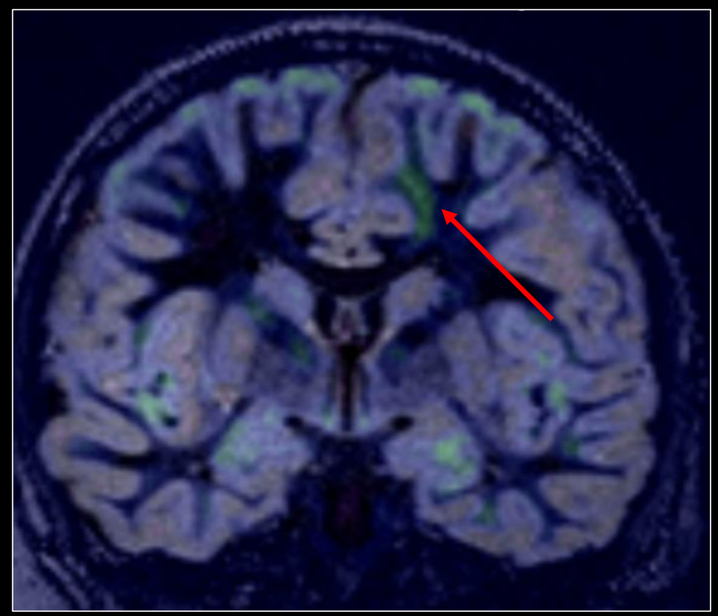
DIR sequence



MAP-E Overlay



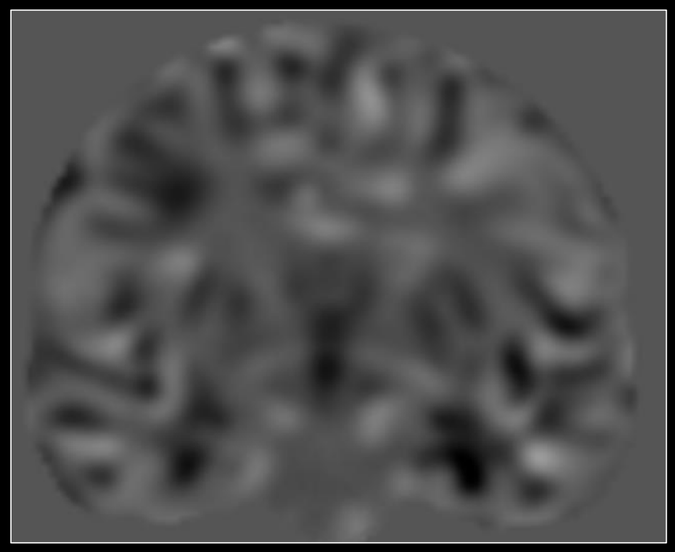
MAP-J Overlay



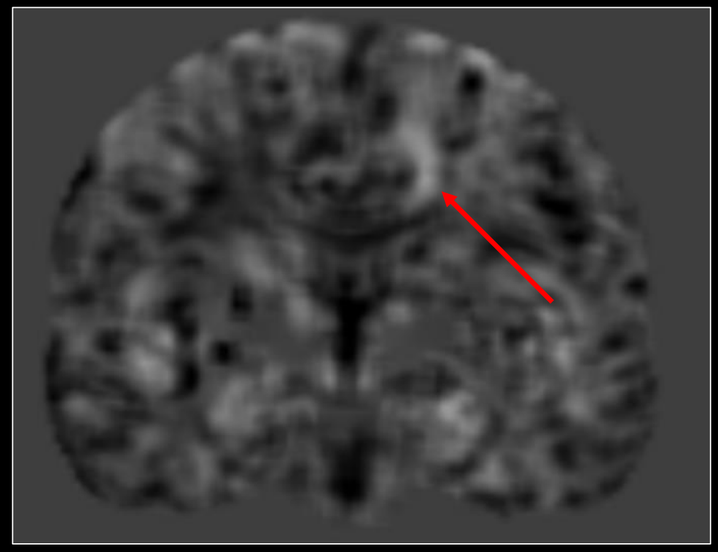
A 16 yo girl with medically intractable epilepsy and pathology proven Type 2A FCD after SEEG implantation and resection. Initial 3T MRI was read negative.

DIR MAP-J shows a curvilinear bright spot in mesial left frontal lobe (arrow). MAP-E is not as conspicuous. MAP-J grayscale also shows this focus similar to MAP-J overlay, Relook at DIR coronal image showed curvilinear subcortical white matter hyperintensity (arrow)

This region was confirmed as seizure onset zone on SEEG. Cortical resection was performed and pathology showed Type 2A FCD



MAP-E Grayscale



MAP-J Grayscale