Temporal lobe epilepsy (TLE) is well-controlled by surgical resection of the mesial temporal lobe. Precise localization of the epileptogenic zone is extremely crucial for successful surgical treatment. However, MR perfusion measurement in temporal lobe usually suffers from magnetic susceptibility artifacts. Here we propose an arterial spin labeling technique which combines FAIR (Flow-sensitive Alternating Inversion Recovery) for spin preparation with HASTE for image acquisition (FAIR-HASTE) to detect inter-ictal hypoperfusion in patients with TLE. The results obtained from MR perfusion imaging in TLE were then compared with those derived from H215O PET imaging. Perfusion was measured for eight TLE patients. MR images were acquired immediately following the PET scan. MRI was performed on a 1.9 T GE/Elscint Prestig scanner. PET imaging was performed on a GE 4096 camera. The parameters of the FAIR-HASTE acquisition were: inter-echo spacing = 7.2 ms, 80 echoes, acquisition time per image = 595 ms (excluding TI), slice thickness = 7 mm, in-plane resolution = 3.0 mm × 3.0 mm, TR/TE/FA= 2000 ms/65 ms/900, TI = 1000 ms. Consistent hypoperfusion was shown by both modalities. No significant spatial distortion or susceptibility artifacts were found in the region of the temporal lobe. A statistically significant positive linear correlation was found between the asymmetry indexes measured by MRI and PET, with a correlation coefficient of 0.75 (p < 0.05). In conclusion, MR perfusion imaging based on the FAIR-HASTE technique was capable of detecting inter-ictal hypoperfusion in TLE without susceptibility artifacts even in the region of the inferior temporal lobe.