

Meyer's loop delineated on magnitude images of susceptibility-weighted imaging: pre- and postoperative perimetric correlation in patients with refractory temporal lobe epilepsy

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Introduction: It has been reported that magnitude image of susceptibility-weighted imaging (mSWI) can delineate the entire length of the optic radiation (OR) as a low signal intensity bundle (LSB) lateral to the lateral ventricle, including the anterior part of OR (Meyer's loop, ML) which cannot always be depicted by diffusion tensor tractography [1]. For further clinical application, however, validation of the LSB on mSWI as the OR in each subject is indispensable.

Methods: Patients with refractory temporal lobe epilepsy who underwent surgery with pre- and postoperative mSWI and with post- and/or preoperative perimetry were included in this retrospective study. On 3T MR, transaxial mSWI were acquired with the following parameters: repetition time / echo time, 27msec / 20msec; flip angle, 15°; matrix, 352–384×448; field of view, 180–197mm×230mm; voxel size, 0.51mm×0.51mm; 88 slices, with 1.2mm thickness [2]. The findings of the anterior part of LSB (aLSB) on pre- and postoperative mSWI were analyzed and compared with the findings of post- and/or preoperative Goldmann perimetry in each subject.

Results: Nine patients comprising 2 with brain tumor (BT), 4 with mesial temporal sclerosis (MTS), 1 with arterio-venous malformation (AVM), and 2 with cavernous malformations (CM) were included (3 males and 6 females, 27 ± 10 (8–46) years old). The patients with BT showed homonymous upper quadrant anopsia (H-UQA) on perimetry only after surgery, corresponding to the damage to the aLSB. Among the 4 patients with MTS, 3 experienced H-UQA only after surgery, 1 had no visual field defect both before and after surgery, corresponding to the extent or the absence of the damage to the aLSB. The patient with AVM, who underwent surgery twice, demonstrated H-UQA on post-1st-operative perimetry, which was deteriorated after 2nd surgery, corresponding to the expanded damage to aLSB. Of both patients with CM, 1 had H-UQA only after surgery and 1 had no visual field defect both before and after surgery, however, the preoperative evaluation of aLSB was limited because of strong susceptibility effects due to hemorrhagic products of CM. On preoperative mSWI, aLSB were firmly identified in 6 of 9 patients (67%).

Discussion: ML can be damaged through operative procedures involving the anterior temporal lobe, resulting in the contralateral H-UQA, while the location of ML is well known to have large intersubject variations [3–8]. Thus, there is a strong clinical demand for preoperative identification of this fiber bundle on MRI in each subject [9]. In the present study the postoperative collapse of aLSB on mSWI was shown to be well correlated with the H-UQA on postoperative perimetry, proving the validity of the preoperative identification of this fiber bundle on mSWI for preventing unpredictable visual field defect. In the meanwhile, only 67 % of the anterior tip of ML was firmly identified preoperatively, less than that of the former report (100%) on healthy volunteers [1]. Some of the possible reasons are strong susceptibility effect due to hemorrhagic products, perilesional edema and dysplastic tissue having different T1 and T2 relaxation times [10], and subject's motion.

Conclusion: The aLSB on mSWI represents ML. Susceptibility artifacts due to hemorrhagic products and motion artifacts can impede the interpretation of aLSB.

References: [1]. Mori N, et al. Invest Radiol 2009; 44:140, [2]. Reichenbach JR, et al. Radiology 1997; 204:272, [3]. Ebeling U, Reulen HJ. Acta Neurochir (Wien) 1988; 92:29, [4]. Barton JJ, et al. Brain 2005; 128:2123, [5]. Hughes TS, et al. Neurology 1999; 53:167, [6]. Krolak-Salmon P, et al. Br J Ophthalmol 2000; 84:884, [7]. Peuskens D, et al. Neurosurgery 2004; 55:1174, [8]. Choi C, et al. Neurosurgery 2006; 59:ONS228, [9]. Ray A, et al. Br J Neurosurg 2002; 16:456, [10]. Rugg-Gunn FJ, et al. Neuroimage 2006; 31:39.

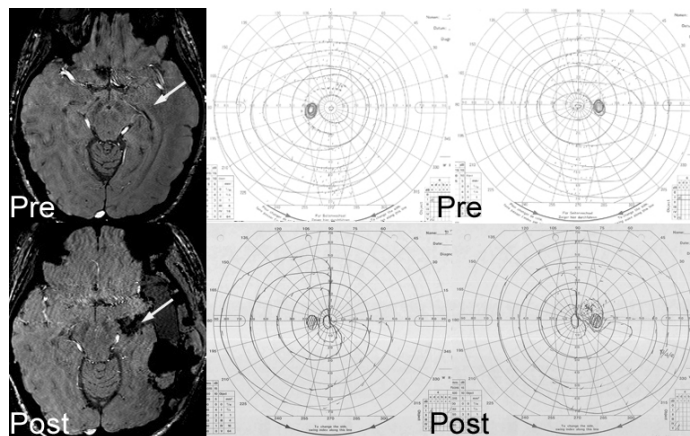


Figure. Pre- and postoperative mSWI (left column) and perimetry (middle and right columns) of 31-year-old female with left mesial temporal sclerosis.