FLAIR-/T1-/T2-co-registration for image-guided diagnostic and resective epilepsy surgery.

Abstract:

OBJECTIVE: For technical reasons, T2-weighted and fluid-attenuated inversion recovery (FLAIR) magnetic resonance imaging (MRI) sequences do not allow morphological orientation with high anatomic resolution, but they may show small epileptogenic lesions. Considering the peculiarities of diagnostic and resective epilepsy surgery the present study focused on the co-registration of various magnetic resonance sequences for guided epilepsy surgery. METHODS: Fifty patients (24 men; 26 women) aged 2 to 74 years (mean, 32 yr), in whom epileptogenic lesions were not readily identifiable on three-dimensional T1-weighted MRI scans underwent additional two-dimensional T2-weighted and FLAIR sequences before diagnostic and/or resective epilepsy surgery. FLAIR and/or T2-weighted images were co-registered to the T1-weighted data set and were displayed on the navigation station on site for guided invasive diagnostics and for resection according to an individualized resection plan. Postoperative MRI scanning was routinely performed for assessment of resection extent. RESULTS: Co-registered T1- and FLAIR-/T2-images allowed for image-guided intraoperative identification of all lesions ($n = 50$). Control MRI scans revealed that complete resection was performed as planned before the operation in 49 patients and incomplete resection was performed in one patient. Preliminary
seizure outcome with a mean follow up of 14 months (range, 7-24 mo) was assigned according to the Engel classification: Class I, 78%; Class II, 12%; Class III, 4%; Class IV, 6%. CONCLUSION: Image guidance on the basis of image fusion/co-registration of T1- and FLAIR-/T2-images allows for intraoperative identification of otherwise poorly visible lesions on standard MRI sequences in good spatial resolution. Recall of this information during surgery from the navigation system's screen assists in achieving the goal of precise electrode placement, or complete resection of the lesion as well as of the perilesional epileptogenic tissue and improves the surgeon's intraoperative orientation.