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Integration eines Resektionsplans basiert auf digitaler Photographie in die präoperative MRT für die Plannung Epilepsiechirurgischer Eingriffe

Integration of a digital photography based resection map into preoperative MRI for planning of epilepsy surgery

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Objective

Subdural electrodes are used for localisation of the seizure-onset zone and delineation of eloquent cortical areas prior to resective epilepsy surgery. Aim of this study was the integration of a digital photography based resection map, made after implantation of subdural electrodes and following functional mapping, into the preoperative MRI for individualized planning of resective epilepsy surgery.

Methods

Digital photographs of exposed cortex were taken before and after implantation of subdural electrodes in n=6 patients. According to functional mapping, a resection map was created overlying the native cortex digital photograph with the drawn electrode points. The patients underwent 3-D MRI for navigated placement of the subdural electrodes. Rendering software (Analyze 3.1) was used to create a MRI-3D model of the brain surface. The digital photograph included resection map was co-registered manually with the brain surface model using the registration tool of Analyze software. By matching the digital photograph and the brain surface model the position of the subdural electrodes was integrated into the coordinate system of the preoperative 3-D MRI dataset.

Results

In all patients the position of electrodes and related functional data of resection map could be visualized on a 3D-model of the brain. The matched digital photograph with a realistic view of the related cortex and the integration into MRI at the same time allows for improved resection planning of the epileptogenic lesion.
Using the anatomical and functional information of the digital cortex photograph with the visualised electrode contact position enhanced the safety and orientation for resective surgery.

Conclusion

We describe a new method of matching digital photographs acquired during surgery and preoperative MRI-based 3D-models for visualisation of subdural electrodes. The digital photograph based resection map integrated into MRI allows for identification of anatomic details underlying the subdural grids and enhance the orientation by knowing the position of subdural electrodes on MR-images. Further integration of this method into neuronavigation may increase the precision of neocortical epilepsy surgery.