

Plastizität des Gehirns gemessen bei der Präoperative Funktionsdiagnostik

Observation of brain plasticity during presurgical functional brain mapping

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Objective

For planning and intraoperative guidance of brain tumor surgery adjacent to eloquent cortex it is mandatory to have individual localizations of the affected brain functions to avoid postoperative neurological deficits. Particularly individual data are necessary firstly because of interindividual anatomical differences (e.g. in language areas). Secondly gyri may be shifted by the lesion and therefore difficult to identify. Thirdly functions may have been transferred into other brain areas because of brain plasticity. Finally it is desirable to evaluate the hemispheric dominance.

Patient and Methods

We used a 2 x 37 channel biomagnetometer with first order gradiometers (MAGNES II, 4D Neuroimaging, San Diego, CA) for the precise localization of language processing brain areas for presurgical functional imaging in a 33 year old patient with a recurrent glioma adjacent to Wernicke's area and the supramarginal gyrus. Source localization was calculated by the single dipole model and also current density distribution (spatial filter beamformer, CLSF). We applied a silent reading, silent naming and a calculation task and measured the evoked activity with MEG and fMRI. The measurements were performed before the first and second surgical treatment 5 years later. These results were transferred to and visualized during surgery by a neuronavigation system.

Results

We were able to localize language and cognitive functions. We observed changes of language activity under the influence of the tumor and the surgery.

The patient showed a decline of MEG language activity in the left hemisphere compared to the previous measurement during a reading task. Before the second surgery she had very strong activities arising from areas which correspond to language in the right hemisphere. FMRI was measured the second time and accordingly showed right hemisphere dominance. Surgery produced no permanent functional deficits in language, reading and calculation, though structures were resected, which are normally used during calculation. Writing was only mildly clumsy. After the first surgery the patient had mild speaking and reading difficulties, which resolved. After the second operation she did not reveal any speech disturbances.

Conclusions

We conclude that functional neuronavigation is especially important in recurrent tumor surgery adjacent to eloquent brain areas. Our data suggest that an interhemispheric shift of language related areas can occur in patients with slowly progressive lesions. Which contributing factors also influence brain plasticity is subject of further investigations.