Section: **Intraoperative Bildgebung**

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Abstract-Title:
SAFETY MARGINS TO THE PYRAMIDAL TRACT VISUALIZED BY FIBER TRACKING

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Abstract-Text:
Purpose
One of the most common problems in glioma surgery is the extension of the resection in eloquent areas. While functional navigation of cortical areas has widely been introduced into such operations, intraoperative display of fiber tracts is still a challenging enterprise. In this study, functional surgical outcome depending on the distance between tumour resection and the pyramidal tract visualized by implementation of fiber tract navigation supported by intraoperative MR imaging was examined.
Methods
Glioma surgery in 57 patients (32m, 25f) with low (WHO I: 3; WHO II: 11) and high grade (WHO III: 22; WHO IV: 21) gliomas was performed. In all patients anatomical neuronavigation was combined with visualization of a 3D object representing the pyramidal tract in the surgical field. Fiber tract seeding was based on a multiple volume of interest approach. The fMRI data identified the motor gyrus as the major start region. A tensor deflection algorithm was used for tracking. The distance between glioma and the pyramidal tract was measured in 3D and classified into four subgroups: >10 mm, 10-5 mm, 5-0 mm, <0 mm (in the latter the tumour virtually reaches the pyramidal tract). Hulls wrapping the fiber tract bundle marked safety margins. To compensate for the effects of brain shift, intraoperative high field magnetic resonance imaging was used to update the navigational setup including the fiber tract data.
Results
In all cases visualization of the pyramidal tract in the surgical field by diffusion tensor imaging and measurement of the minimum distance to the segmented tumour could be performed. In 31 patients the glioma reached the pyramidal tract (54.4%). The distribution in the other subgruops was 4 (0-5 mm), 7 (5-10 mm) and 15 (>10mm), respectively. With the intraoperative update of the fiber tract information by application of intraoperative diffusion tensor imaging, a shifting of the pyramidal tract up to 13 mm could be proved. A new or increased postoperative neurological deficit could be observed in 6 (10.5%) patients, which was permanent in only 1 (1.7%) case. In 5 of them it was transient. All of these 6 patients were assigned to the subgroup in which the tumour reached the pyramidal tract, so that in this group was a risk for a permanent deficit of 3.2% (transient 16.1%). In the other subgroups no new or aggravated deficits coudl be observed postoperatively.
Conclusion
The course of the pyramidal tract can be reliably visualized by implementation of fiber tracked data in neuronavigational setups based on diffusion tensor imaging. The effect of brain shift during the operation can be largely compensated by updating the neuronavigational data set with intraoperative high field MR imaging. Hulls wrapping the

visualized fiber tract bundle representing the pyramidal tract can be used for marking safety margins. This knowledge about the course of the pyramidal tract allows the surgeon the performance of glioma resection with low postoperative morbidity.