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Background and purpose: Surgical therapy is considered in most patients with brain tumors. Theoretically DTI should improve the demonstration of pathology and topographical relationship of brain tumors on MRI. Depending on the particular morphology and location of brain tumors several considerations for surgery are of importance. These include the evaluation of the lesion site in regard to the tissues involved (eloquent cortex, white matter tracts), anatomical landmarks and a detailed appreciation of the area involved in the surgical approach. Neurosurgeons are highly trained in regard to brain anatomy and use conventional MRI or CT as an essential part of their work. Although the practical value of DTI is hard to assess as treatment decisions are frequently based on personal experience and preferences in regard to brain imaging modalities we attempted to explore DTI information from a realistic standpoint. We used a "subjective" expert educated approach to evaluate the potential value of DTI derived information. We considered a systematic neurosurgical review as usually performed on conventional MRI and in addition DTI derived imaging in patients with different etiologies of mass lesions.

Patients and Methods: MRI of 20 patients with various brain neoplasia diagnosed histopathologically or from MR/CT morphology (anaplastic glioma, low grade glioma, meningioma craniopharyngioma, lymphoma, ependymoma, cystic mass lesions) were investigated. MRI was performed with a 1.5 T Magnetom SONATA, SIEMENS. A standardized preoperative MRI protocol was used (3 localizers, T_2w-TSE, T_1w-SE, T_1w-SE after contrast, DTI). In addition DTI was performed, single-shot DW FLAIR-SE-EPI (TR/TI/TE = 6000/2000/110 ms, slice thickness TH = 5 mm, FOV = 240x240 mm^2, MAT = 128x128, interp. 256x256) containing gradient lobes for DW (b = 0, 1030 sec/mm^2). Amplitude images were averaged from 8 measurements. Distortions due to residual eddy currents were corrected afterwards. After tensor diagonalization and calculating the eigenvectors, maps of the trace(D) (ADC), the lattice anisotropy index (LAI) and color coded DTI maps were evaluated.

Two senior neurosurgeons analysed the complete data set in a setting and for considerations common to the clinical situation in brain tumor therapy. Firstly conventional contrasts were considered, subsequently DTI derived data.
Lesions were described and rated in regard to:

1. Anatomical location
2. Characteristics on conventional MRI (T2w, T1w before and after contrast) Anatomical borders (sharp vs fuzzy), involved fiber tracts; compressive effects, infiltrative or destructive growth. Indication for surgical therapy. Surgical access path.
3. Characteristics after consideration of color coded DTI: Tumor delineation on DTI, fiber tract involvement, growth characteristics. Indication for Operation?
4. Information of DTI was rated in regard to alterations of i) indication for surgery ii) surgical risk reduction due to improved anatomical information iii) extent of surgical resection
5. Whether further demonstration of large fiber tracts might be of value

Results: According to the standardised assessment DTI allowed the visualisation of major fiber tracts affected by the tumor. On conventional MRI these fiber tracts were estimated from prior anatomical knowledge. DTI information did not alter the indications for surgical therapy in any patient. DTI improved the presurgical assessment in regard to a risk reduction of surgery in 8/20, in further 4/20 patients a possible risk reduction. DTI led to an increase of the planned area for surgical resection in 6/20, while the extent of surgical removal was unchanged in 14/20. Further fiber tracking of large fiber tracts in the vicinity of or involved in the tumor was thought to be valuable in 14/20 patients.

Conclusion: Although conventional MRI appears sufficient in most situations DTI provides more anatomical detail visually (that is otherwise assumed from anatomical knowledge), that in high proportion of patients adds into the concept of the presurgical work-up and surgical planning. Given the present results there is additional information provided by color coded DTI studies even though fast standard resolution MRI was obtained. Both lesion characteristics and anatomical information on the main white mattter pathways were felt to be useful adjunct information occasionally altering considerations concerning surgical approach or extent of tumor resection or preoperative surgical risk assessments. Given those results DTI should be considered as a routine adjunct information to educate clinicians on its characteristics and use.