

Dynamic Susceptibility Contrast Perfusion MRI of Angiogenesis and Microscopic Tumoral Infiltration in the Corpus Callosum of Patients with Gliomas

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Introduction: Dynamic susceptibility contrast perfusion MRI (DSC MRI) allows determination of the pathology and biology in the abnormal and normal brain of patients with gliomas (1-4). The purpose of this study is to determine if there are microvascular changes within the normal appearing corpus callosum (CC) and contralateral white matter of patients with gliomas and if there are differences between glioma grades.

Materials and Methods: 30 patients with a primary glioma had DSC MRI. These were classified using the WHO classification: Grade II- low-grade gliomas (n=10); Grade III- anaplastic gliomas (n=12); and Grade IV- glioblastoma multiforme (n=8). Dynamic susceptibility contrast-enhanced gradient-echo perfusion images were acquired during the first pass of a bolus injection of gadopentetate dimeglumine at 1.5T. The maximal rCBV was measured from the perfusion color maps. ROIs were placed in the corpus callosum in three locations, the ipsilateral callosum (CC-IPSI), central callosum (CC-CENT) and contralateral callosum (CC-CONT) to the side of the glioma, as well as within the contralateral normal appearing white matter (NAWM-CONT). The genu was studied for fronto-temporal tumors and the splenium was studied for parieto-occipital lesions.

Results: P values comparing rCBV in different regions of the CC between glioma grades are summarized in Table 1. There is significantly increased rCBV in the ipsilateral CC in grade III gliomas compared with grade II as well as in grade IV gliomas compared with grade II. There is also significantly increased rCBV in central and contralateral CC in grade III gliomas compared with grade II. The rCBV in the ipsilateral CC for grade II was 0.98 ± 0.33 versus grade III 1.35 ± 0.66 versus grade IV 1.50 ± 0.65 . The rCBV for grade II in the CC-CENT and the CC-CONT were respectively 1.05 ± 0.41 and 0.96 ± 0.40 versus 1.31 ± 0.56 and 1.27 ± 0.54 for grade III.

Conclusion: DSC MRI is able to demonstrate changes in rCBV in the normal appearing corpus callosum indicating potential microscopic tumoral infiltration and neovascularity. Serial studies are underway to determine if there is tumoral infiltration on follow-up imaging as well as correlation with clinical outcome.

References:

1. Law M et al, Am J Neuroradiol 2003; 278-285
2. Kemp PM et al Radiology 1994; 637-41
3. Cha S et al. radiology 2002; 294-9
- 4 Sugahara T et al. Am J Roentgenol 1998; 1479 -1486.

Table 1. P values comparing relative CBV values for three different corpus callosum and normal appearing white matter locations in different glioma grades.

GLIOMA GRADE	NAWM-CONT	CC-IPSI	CC-CENT	CC-CONT
II vs III	0.54	0.01	0.04	0.01
II vs IV	0.39	<0.005	0.37	0.17
III vs IV	0.51	0.43	0.71	0.28

NAWM-CONT=Appearing white matter contralateral to the side of the glioma, CC-IPSI = ipsilateral callosum, CC-CENT = central callosum, CC-CONT= contralateral callosum.

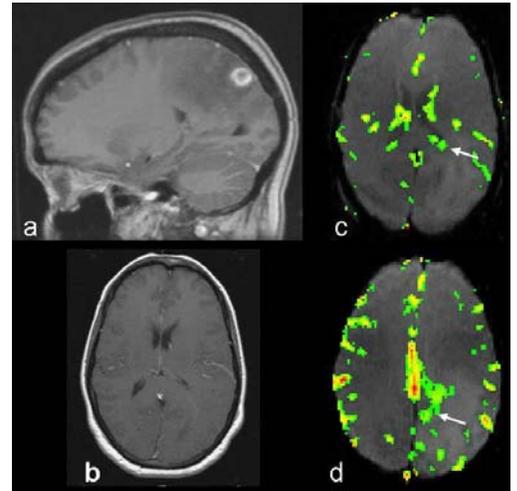


Figure 1. Contrast-enhanced sagittal (a) axial (b) T1 and Gradient echo rCBV map (c-d) showing high CC perfusion without enhancement in the CC.