Vessel size imaging of brain tumors

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Introduction

Vessel size imaging (VSI), based on R_2^* and R_2 measurements, can provide in vivo quantitative assessment of microvascular dimensions in the brain (1, 2). Recently, feasibility of clinical application of VSI technique in cerebral tumors has been reported (2). Microvascular proliferation in polymorphous pattern has been identified in certain type of brain tumors (3). In vivo information concerning vessel calibers provided by VSI might help to differentiate different brain pathologies. This study was conducted in patients with meningiomas and anaplastic astrocytomas using VSI to evaluate the possibility of differential vascular size between these tumors.

Methods

Six patients (3 with meningioma, 3 with anaplastic astrocytoma) were recruiter for this study. All the MRI studies were performed on a 3T MRI scanner (Signa Excite, GE). In addition to convention MRI for structural evaluation, perfusion-weighted MRI using spin-echo (SE) and gradient-echo (GE) echo-planar imaging (EPI) sequences were conducted separately with a 10-minute internal. GE-EPI study was acquired with TR = 1500 ms, TE = 35 ms, FOV = 22 cm, matrix = 64 x 64, slice thickness = 5 mm, and 0.2 c.c. Gd-DTPA (Magnevist)/kg at 4 c.c/sec. SE-EPI was acquired with the same parameter except TE = 70 ms. For measurement of apparent diffusion coefficients, diffusion-weighted MRI with b = 1000 was performed in every MRI study. Analysis of vessel caliber was performed at region of interest in the gray matter (GM), the white matter (WM), and the enhancing tumor.

Results

Mean vessel calibers of GM, WM and tumor in the 6 patients were shown in Table 1. Consistent measurement of cerebral vessel size in GM and WM across different subjects indicated feasibility of VSI technique used in the present study. Interestingly, mean vessel calibers of 3 meningiomas, in terms of micrometer, were larger than those of 3 anaplastic astrocytomas. Convention MRI and VSI of a meningioma (Figure 1) and an anaplastic astrocytoma (Figure 2) show significantly enlarged vascular size as compared with normal brain.

Table 1. Vessel size (2R in micrometer) of GM, WM and tumors

	Meningiomas			Anaplastic astrocytomas		
	Patient 1	Patient 2	Patient 3	Patient 1	Patient 2	Patient 3
GM	38.7	33.4	32.5	29.4	28.5	
WM	24.6	18.7	27.0	20.2	25.1	32.4
Tumor	90.1	60.8	95.2	57.5	38.0	42.4

Fig. 1.

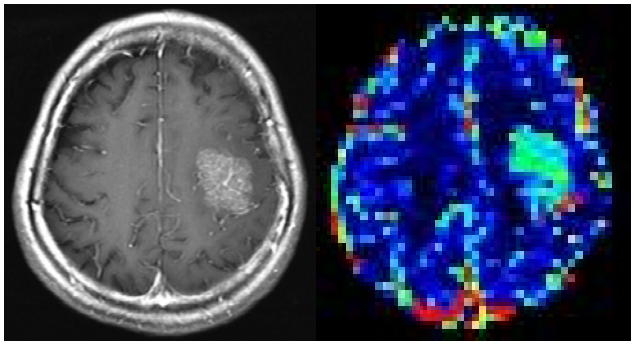
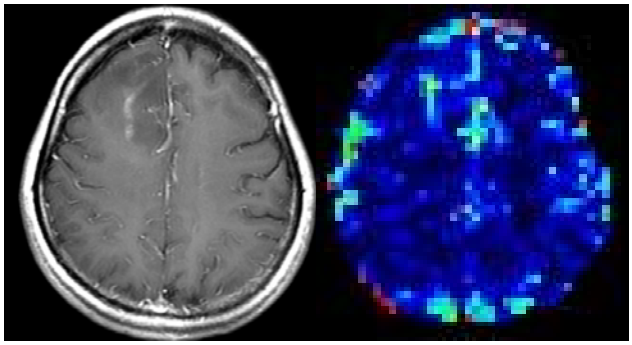


Fig 2.



Discussion

Results of this study showed that meningiomas and anaplastic astrocytomas have different vascular dimensions which can be delineated by VSI. These preliminary findings indicated that VSI technique can provide in vivo microvascular information of different brain tumors which might be helpful in clinical application. Further evaluation in various types of brain pathologies of a large cohort is conducting in our center.

References

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