Perfusion Imaging of Brain Tumor Using Pulsed Arterial Spin Labeling: Correlation with Histopathological Blood Vessel Proliferation

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Introduction

Pulsed arterial spin labeling (PASL) is an MR method for perfusion-weighted imaging (PASL-PWI) without any extrinsic tracer administration. PASL has been used to evaluate brain tumors in a few previous reports. However, the relationship between PASL-PWI and histopathological findings has not been sufficiently investigated. We compared PASL-PWI and histopathological blood vessel proliferation of brain tumors.

Materials and Methods

Between 2005 and 2006, we examined 14 patients with brain tumors (7 men and 7 women; age range, 45-70 years old; 2 glioblastomas, 2 anaplastic oligodendrogliomas, 1 diffuse astrocytoma, 1 dsyembryoplastic neuroepithelial tumor, 3 hemangioblastomas, 3 meningiomas, and 2 atypical meningiomas). PASL-PWI was performed using Q2TIPS at a 1.5T MR unit (Magnetom Symphony, Siemens). Q2TIPS parameters were set as follows: TI1 = 900ms, TI1s = 1300ms and TI2 = 1400ms. Images were acquired at 5 slice levels sequentially in a proximal to distal direction using a single-shot EPI technique (slice width = 5mm, interstice gap = 2.5mm, TR = 2100ms, TE = 26ms). PASL-PWI was acquired from the average of 50 difference images obtained by subtracting the unlabeled image from the labeled image at each slice position. The relative perfusion of the tumor was evaluated by the relative signal intensity rate (%Signal), which was defined as the percentage of the maximum signal intensity of the tumor divided by the averaged signal intensity of the gray matter on PASL-PWI. Surgically obtained specimens were immunostained for CD34 to identify the vascular endothelial cells. The relative blood vessel proliferation rate (%Vessel) was defined as the percentage of the total area of lumina surrounded by the endothelial cell layer per the area of the entire microscope field of 20 x-objective. The correlation between %Signal and %Vessel was statistically analyzed using Spearman's signed rank test and the simple regression analysis.

Results

Figure 1 shows the plot of %Signal against %Vessel. A strong correlation between %Signal and %Vessel was observed (r^2 = 0.886; $p<0.005$). Figure 2 shows PASL-PWI of an atypical meningioma.

Discussion

It was suggested that PASL-PWI can be used to estimate the blood vessel proliferation of the brain tumors. PASL-PWI might be useful in differential diagnosis and perhaps in prediction of the perioperative bleeding from brain tumors.

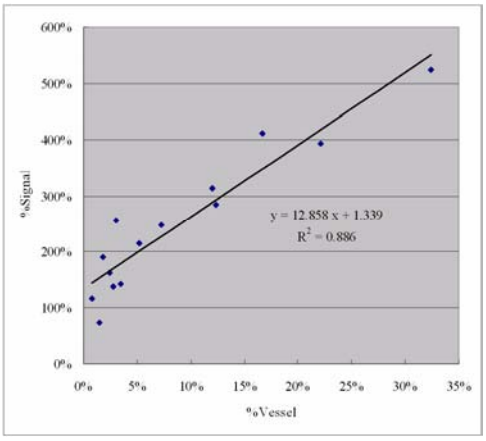

Figure 1: The relationship between %Signal measured with PASL-PWI and %Vessel obtained by immunostaining for CD34.

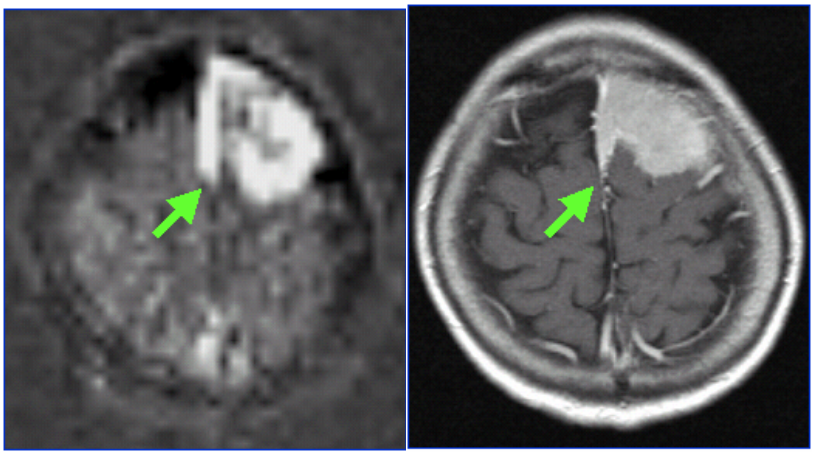

Figure 2: PASL-PWI (left) and Gd-enhanced T1WI (right) of an atypical meningioma.

References

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2. Luh WM, et al. Magn Reson Med. 1999;41:1246-1254.