

Introduction

Parameters related to perfusion and blood flow are critically important markers of tumor angiogenesis, drug delivery, metabolic status and response to therapy. We present relatively non-invasive MRI methods for in-vivo assessment of multiple parameters of tumor microvasculature. These parameters include: vascular permeability, fractional blood volume (fBV), and vessel size index (VSI).

Methods

Measurements were performed on mouse models with implanted flank tumors. Images were obtained on a General Electric 3.0T Signa/Horizon MR Imager/Spectrometer. Permeability measurements were made using an extravascular contrast agent (Gd-DTPA) and the method of Brasch(1). Fractional blood volume and vessel size index was measured with an intravascular contrast agent (super-paramagnetic iron oxide particles: ferumoxytol, Advanced Magnetism, Inc.) using the method of Tropres(2).

Results

Permeability was assessed using serial T1-weighted images in which the tumor enhancement due to vascular "leakage" was compared to a reference normal muscle site. VSI and fBV were estimated from changes in relaxation rates measured before and after contrast injection for both gradient-echo ($R2^*$) and spin-echo ($R2$) sequences. VSI was assessed by the relative ratio of relaxation rates ($\Delta R2^*/\Delta R2$) as compared to normal muscle. Relative blood volume was estimated by the change in $R2^*$.

Discussion

MRI techniques provide potentially important noninvasive methods for assessing tumor microvascular status. Preliminary results have shown that changes in VSI and fBV accurately reflect tumor growth and response to therapy.

Supported in part by NIH/NCI R25-CA92043

References

- 1) Brasch, et al. European Journal of Radiology 34:148-155 (2000)
- 2) Tropres, et al. Magnetic Resonance in Medicine 45:397-408 (2001)