QUANTITATIVE DYNAMIC CONTRAST-ENHANCED MAGNETIC RESONANCE IMAGING OF THE BREAST

Greg O. Cron
Under the supervision of Giles E. Santyr
At the University of Wisconsin - Madison

Methods were developed for performing quantitative dynamic contrast-enhanced magnetic resonance (MR) imaging.

To measure the concentration of the contrast agent in tissue rapidly and repeatedly, the MR image intensities from a T_1-weighted spoiled gradient-recalled echo (SGRE) pulse sequence were converted to T_1 by a calibration curve obtained from slower (minutes), conventional T_1 measurements performed before and after the dynamic imaging. This method permitted accurate (10\%), rapid (seconds) measurement of T_1 during dynamic MR imaging for the range of T_1 values expected in vivo (approximately 300 to 1200 ms), even in the presence of imperfections in the slice profile and transmitter coil magnetic field.

To measure the arterial input function with high temporal resolution (secondss) and reasonable accuracy (20 to 30%), changes in T_2* in the aorta were measured with a single-echo T_2*-weighted SGRE pulse sequence. The changes in T_2* were converted to concentration by a calibration curve obtained from a series of experiments involving simultaneous MR imaging and invasive arterial blood sampling.

These methods were used to measure the extraction-flow product (EF) and tissue cell fraction (TCF) in six Walker-256 rat tumors and four human breast lesions.