Simultaneous Dynamic Contrast-Enhanced MRI of Four Mice with Induced Tumors on a 1.5 T Clinical Scanner

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1. Introduction
The aim of this project was to evaluate the feasibility of simultaneous measurement of tumor perfusion with multiple small animals on a 1.5 T clinical scanner. These scanners are broadly available and provide the necessary basic protocols for patient examinations. In this study anatomical images for determination of tumor size as well as dynamic contrast-enhanced MRI were obtained. Simultaneous imaging shortens the imaging time for a large number of small animals [1].

2. Methods
A homebuilt 4-channel receive array for imaging rat brains was used for this experiment [2]. The examined small animals were nude mice. Two weeks before the measurement an experimental cell line of squamous cell carcinoma was induced subcutaneously [3]. All measurements were performed on a 1.5 T clinical scanner (Magnetom Vision, Siemens Medical Solutions, Erlangen, Germany). T1 weighted images (Spin echo, TR/TE 700/14ms, α=90°, FOV=110mm, matrix = 512x512, resolution = 0.2x0.2mm², slice = 1mm, 2 acquisitions, t=12 min) were acquired for the anatomical tumor analysis and slice planning prior to DCE-MRI (SR-TurboFLASH, TR/TE 2.4/1.2ms, TI = 320ms (time to the acquisition of k-space center), α=18°, FOV=150mm, matrix = 256x256, resolution = 1.9x1.2, slice = 4mm, t=1.8 min) for tumor perfusion imaging. A solution of 100µl Gd-DTPA (Magnevist, Schering, Germany) in dilution of 1:2.5 in normal saline was injected simultaneously with four syringes through venous inlets.

3. Results
The simultaneous acquisition of the tumor images worked as expected and yielded high resolution images as can be seen in figure 2. The DCE-MRI also delivered analyzable results after injection of the contrast agent (see figure 3).

4. Discussion and conclusion
The feasibility of simultaneous perfusion measurement in four mice is demonstrated in this study. Another study showed the feasibility with bigger effort on dedicated high field small animal scanner [4]. The presented approach could reduce the examination time also with dynamic small animal studies by a factor of 4. This was possible without sacrificing image quality in comparison to single animal imaging with highest possible resolution depending on gradient field strength.

5. References