Determination of the Arterial Input Function in High Dose Radial Myocardial Perfusion Imaging

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Introduction:

The contrast agent concentration time courses of the myocardium and the arterial supply are necessary to determine quantitative values in first-pass myocardial perfusion imaging. This can be achieved by limiting the contrast agent dose, by using the pre-bolus technique [1] or by acquiring an additional low resolution image [2]. While the first method is limited by the signal to noise ratio, the two other methods need to acquire data only for the assessment of the arterial input function. The aim of this study was to determine the arterial input function directly from high dose radial myocardial perfusion scans.

Material and Methods:

A saturation recovery steady state free precession (SSFP, trueFISP) sequence with radial data sampling was developed and implemented. The acquisition order of the k-space lines was optimized to maximize the angle between succeeding read outs [3]. The sequence parameters were TR 2.8 ms, TE 1.4 ms, flip angle 50°, FOV 400 mm, 128 points per read out, 64 read outs, acquisition time per image 216 ms. The oversampling of the center of the k-space allows the reconstruction of images with different effective delays (TD) after the saturation pulse and thus images with different contrasts [4]. For reconstruction at different TDs an echo sharing filtering scheme was used [5]. Healthy volunteers were examined using a contrast agent bolus of 8 ml Gd-DTPA. Time courses of relative signal increase were calculated by dividing the signal intensity by the mean baseline signal before the arrival of the contrast agent.

Results:

Figure 1 shows the time courses of relative signal increase in the left ventricle from images reconstructed at different effective delays. For short effective delays (18 ms, 41 ms) the curves are identical within the measurement error. For longer TDs (130 ms, 175 ms) the signal intensity in the left ventricle is reduced at high contrast agent concentrations as in conventional Cartesian first-pass imaging.

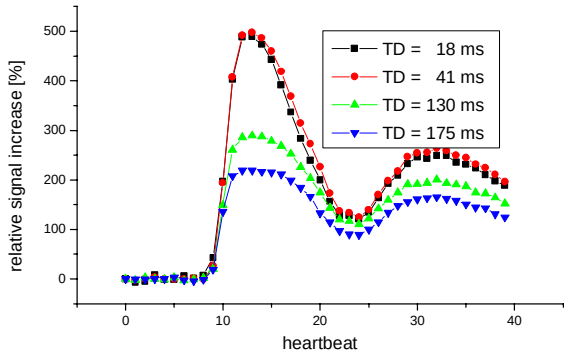

Figure 1: Time courses of relative signal increase in the left ventricle for images reconstructed at different delays after the saturation pulse.

Discussion:

Short effective delays after the saturation lead to a linear dependence of the signal intensity on the concentration even for high contrast agent doses [2]. Radial sampling allows the reconstruction of images with different effective delays. Thus radial myocardial perfusion sequences enable an optimized determination of the contrast agent concentration not only in the myocardium (long TD) but also in the blood pool (short TD) from one data set.

References:

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