Purpose: To develop methods for the acquisition of dynamic contrast media concentration images during routine clinical DCE-MRI.

Methods: We designed calibration phantoms consisting of color-coded tubes filled with gadodiamide solutions (0.0-0.5mM Omniscan), which were placed into a 16-channel bilateral breast coil. Three patients (ages a. 55, b. 50, and c. 41) were scanned at 1.5T (a, b) and 3T (c) with IRB approval. We acquired one variable flip angle gradient echo series, and a T1-weighted dynamic series (3D turbo field echo) before and after a gadodiamide injection (0.1mmol/kg). Under the present experimental conditions 1/T1 is approximately proportional to signal intensity. Allowing us to convert signal intensity to concentration of contrast media, by determining the factor of proportionality from the known T1 values in the phantom. This relation is corrected using the phantom-to-tissue proton density ratio to make it applicable to breast tissue. Concentration images for the different time points in the series were produced, using the signal from the standard dynamic series.

Results: After conversion from signal intensity to concentration, peak contrast media concentration in the parenchyma was measured in the range of 0.26-0.32mM. For patient ‘c’ a mucinous cancer was present in the left breast and had a peak concentration of 0.59mM. The phantom-to-tissue apparent proton density ratios were in the range of 3.75-3.90, and 2.25 for the cancer.

Conclusions:The results of this pilot study demonstrate the possibility of performing quantitative measurements on standard clinical data. The pulse sequence used for the present study is not easy to model accurately; the ‘spoiled gradient echo’ model is not appropriate. However, this approach demonstrates that subtraction images can be converted into quantitative concentration images, even if a good mathematical model is not available. The concentration images could facilitate inter-institutional comparisons, as they allow for the standardization of DCE-MRI across different scanners.