DSC MR-mammography: Tumor characterization using quantitative R2* analysis

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INTRODUCTION
Dynamic contrast-enhanced MR imaging (DCE MRI) is an evolving diagnostic tool for assessment of breast cancer and the
dynamic contrast enhancement curves obtained from T1-weighted images have been shown to be predictive of tumor
malignancy [1]. High diagnostic accuracy has also been obtained from qualitative assessment of signal loss in T2*-weighted
images using dynamic susceptibility contrast (DSC) MRI [2,3]. The purpose of this study was to introduce the transverse
relaxation rate R2*, obtained from a double echo dynamic DSC sequence, as a quantitative biomarker for distinguishing
between malignant and benign breast cancer.

MATERIALS & METHODS
Forty-one patients with verified lesions underwent breast MRI. The study was approved
by the regional ethics committee. The MR examination was preformed on a Philips
Achieva (1.5 T) system with NOVA gradients. The protocol consisted of both a high
spatial resolution THRIVE sequence for tumor identification and a high temporal
resolution sequence for parameter quantification. The two sequences were run in an
interleaved fashion during contrast enhancement (MultiHance 0.2 mmol/kg body
weight, Milan, Italy). High temporal resolution images in the axial plane were created
by a 3D T1 multi shot EPI sequence with two echoes using the following parameters:
repetition time = 42ms, echo times = 5.5 ms / 23 ms, flip angle = 28°, voxel size =
1,69*1,48*4 mm3, number of slices=30, temporal resolution = 2.8 s/image volume with
a total of 77 dynamic series acquired. A PROSET fat suppression technique was applied
along with a SENSE factor of 2.5. The transverse relaxation rate, R2*, was calculated on
a pixel-by-pixel basis by assuming a mono-exponential dependence of signal change on
echo time and parametric images representing the peak change in R2* were generated.
Volume of interest (VOI) delineating all lesions were manually drawn by an experienced
radiologist. Mann-Whitney U tests, and receiver operator characteristic (ROC) curve
statistics were used on the 95-percentile value in each VOI to determine the significance
and the diagnostic accuracy for establishing or excluding malignancy.

RESULTS
Histology identified 22 lesions (54%) as malignant and 19 (46%) as benign. The 95-
percentile peak R2*-value showed a significant correlation to malignancy (p < 0.0001),
and a good diagnostic accuracy with an area under the ROC curve of 0.85.

DISCUSSION & CONCLUSION
The study suggested that peak change in the transverse relaxation rate is a sensitive
biomarker for tumor malignancy in DSC MR-mammography. An additional echo in a T1-
weighted perfusion sequence with a high temporal resolution may therefore improve
the diagnostic accuracy by allowing quantitative assessment of tumor specific changes in
R2*following contrast administration.

REFERENCES
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