Discussion/Conclusion: Quantitative renal T1 perfusion based MRI leads to high quality perfusion images in renal grafts and may have a potential for patient follow-up. The results indicate no correlation between rRBF, rRVD and RI and a weak correlation between rMTT and RI. Future research may indicate whether T1-DCE perfusion parameters provide more accurate information on renal graft status than RI.

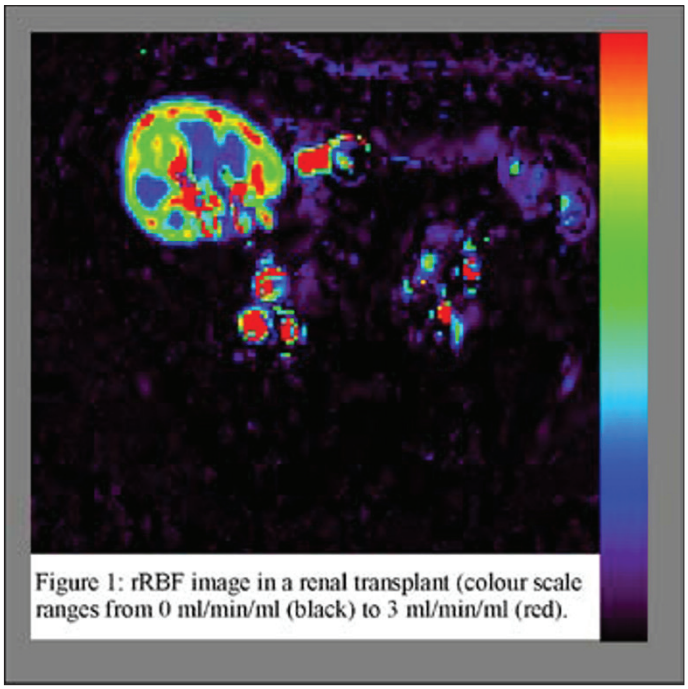

Figure 1: rRBF image in a renal transplant (colour scale ranges from 0 ml/min/ml (black) to 3 ml/min/ml (red).

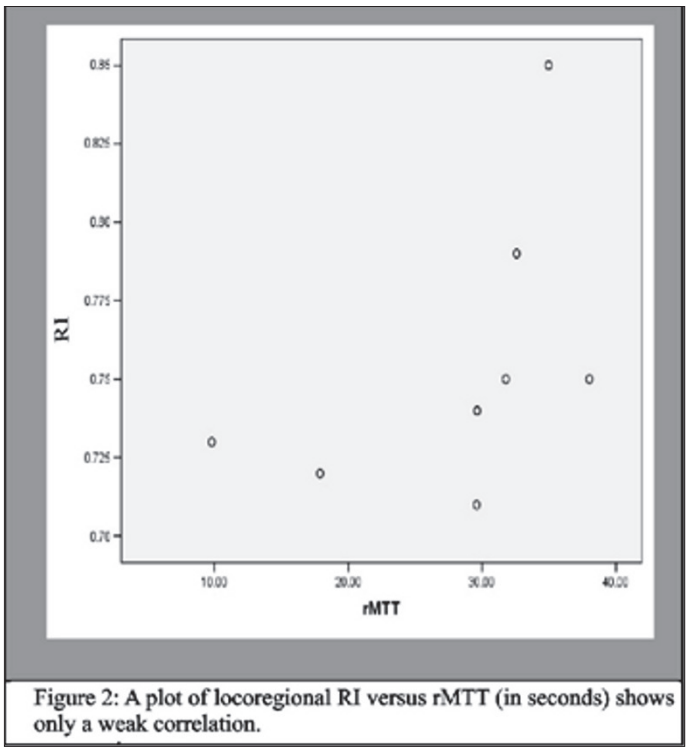

Figure 2: A plot of locoregional RI versus rMTT (in seconds) shows only a weak correlation.

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Motion correction in dynamic DCE-MR studies for the evaluation of the renal function

R. Sance[1], P. Rogelj[2], M. J. Ledesma-Carbayo[1], A. Anderlik[3], F. G. Zoellner[4], J. Rorvik[4], A. Lundervold[3], A. Santos[1]; *[1]Biomedical Image Technologies, Universidad Politécnica de Madrid, Madrid, Spain, [2]Faculty of Electrical Engineering, University of Ljubljana, Ljubljana, Slovenia, [3]Department of Biomedicine, University of Bergen, Bergen, Norway, [4]Department of Radiology, University of Bergen, Bergen, Norway.*

Introduction: Magnetic resonance image(MRI) has been proposed as a non-invasive alternative for assessing kidney function, by using paramagnetic contrast agents like Gd-DTPA, which are predominantly eliminated in the kidneys. After the intravenous bolus administration, the study of the time-intensity courses convey information about the agent accumulation and removal. For these purposes, the geometric displacements of the kidney during the data collection, due to respiratory motion and pulsations, must be compensated. Previous studies deal with manual and 2D-rigid alignment or fast acquisition sequences. In this paper we apply automated non-rigid registration to correct motion and deformation of the kidneys in 3D DCE-MRI series.

Subjects and Methods: Studies were performed comparing data sets of different field strengths, resolution and duration. We assumed the multi-compartmental model of Lee[1] to represent the pharmacokinetics of Gd-DTPA in every kidney region during time. We implemented a first registration method by defining a non-rigid transformation based on a B-Splines field, and including the multiresolution strategy proposed by Kybic[2]. Furthermore, we included the limited-memory implementation of the quasi-Newton BFGS optimizer[3], and the mutual information metric proposed by Mattes[4] to counter the signal intensity changes induced by the tracer passage. A second algorithm, based on Gaussian deformation model and point similarity measures[5], allowed us to compare the proposed method outcome. The optimization procedure was driven using the symmetric approach[6] and also included a multiresolution strategy.

Results: On the registered series (Figure1), anatomical regions of interest (ROIs) were manually selected, and the corresponding time-intensity curves were plotted and compared with the representative predicted profiles of the pharmacokinetic model (Figure2). Results were coherent with those found with the Gaussian deformation model method.

Discussion: Three-dimensional DCE-MR renography with motion correction enables voxel-wise determination of tracer concentration versus time by means of the voxels intensity evolution. The proposed non-rigid registration algorithm, correcting the kidney deformation, is expected to allow more accurate estimation of the local renal function from the time courses in selected ROIs. Consistent results were given by both methods, but further validation with respect to a gold standard is required to assess the accuracy of the algorithm.

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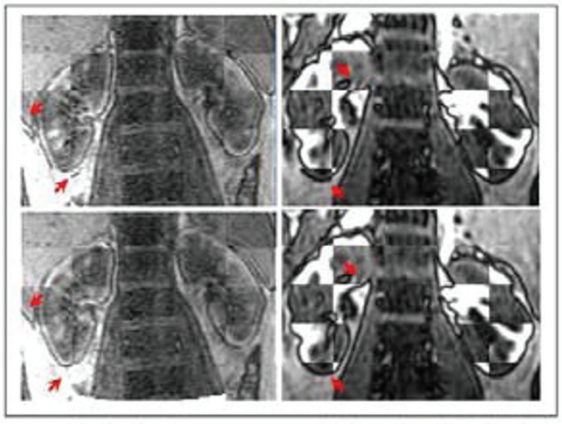

Figure 1. Checker-board images composed of one selected slice belonging to two frames, before (*1st row*) and after (*2nd row*) registration. The series were acquired from a healthy volunteer with a *1.5T Siemens Symphony* scanner (*left*) and a *3.0T Signa Excite GE Medical Systems* scanner (*right*). The continuity of contours (*arrows*) proves the breathing motion compensation carried out by the first proposed algorithm.

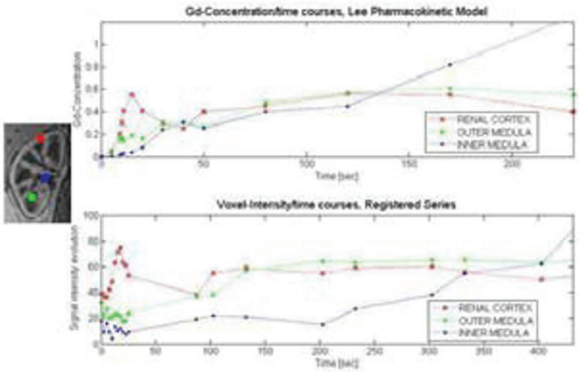

Figure 2. Time courses for the small anatomical regions (colorcoded ROIs on slice on the *left*). *Upper:* Expected representative profiles according to the multi-compartment model proposed by Lee for the Gd-tracer pharmacokinetics. *Lower:* Correspondent voxel-intensity evolution in the same ROIs on the *1.5T* series registered by the first proposed algorithm. Correspondence between the Gd-Concentration and the signal intensity has been approximated without taking in account the real calibration curve.

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The role of combined endorectal Magnetic Resonance Imaging (MRI) and MR Spectroscopy (MRS) in patients with elevated specific antigen (PSA) level and multiple negatives biopsy sessions

M. Petracchini, S. Cirillo, **A. Manca**, T. Gallo, P. Della Monica, D. Regge; *Radiology, IRCC, Candiolo Turin, Italy.*

Purpose: Frequently, urologists are faced with the dilemma of managing patients with PSA suspicious levels but one or even more negative transrectal ultrasonography (TRUS) guided biopsy rounds for prostatic cancer. Aim of the present study was to assess the usefulness of combined endorectal MRI and MRS examinations for these patients.

Patients and Methods: Twenty-two men with a history of elevated PSA level (total PSA > 4 ng/ml) with at least two former negative TRUST biopsy rounds were enrolled prospectively from July 2004 to February 2006 to undergo combined endorectal MR examinations (Signa 1.5 T, GE, Milwaukee) with phased-array torso surface and endorectal coils. Axial, coronal, sagittal T2-w FSE and axial T1-w FSE sequences were performed. Three-dimensional MRS data were acquired by 3D-CSI (TR/TE=1000/130 ms,16x8x8 nominal spatial resolution 0.34 cm^3, acquisition time 17:08min). Volume and frequency selection were obtained by spectral-spatial pulses. Spectra post-processing were performed by commercial software (Functool, GE, Milwaukee). A peripheral prostatic area was classified suspicious either if present low intensity signals on T2 weighted images or if choline+creatine/citrate was $\geq$ 0.97.In all the patients, a 10 cores following peripheral biopsy scheme was done to which were added supplementary samples targeted by MRI or MRS indications.

Results: Mean age ($\pm$ SD) was (65.9 $\pm$5.4) years, mean pre-biopsy PSA level was (12.6 +8.3) ng/ml, mean prostate volume was (78$\pm$36)cm^3, the mean number of previous TRUS rounds was 2.4. Previous histological assessment with evidence of atypia or prostatic intraepithelial neoplasia (PIN) was present in 6 patients (27.2%). After MR examinations histopathology assessed prostate cancer in 8 patients (cancer detection 36.4%), among these patients, four (50%) had prostate cancer disclosed only in additional specimens sampled according to MRI or MRS indications. Combined MRI-MRS suspicious findings and positive biopsy sites were located on the same prostatic zone in all the eight patients. In two cases MRS alone located the positive biopsy zones.

Conclusions: The combination of MRI and MRS improving cancer localization might help the urologist in the management of patients who are at high risk of having prostate cancer.

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Fast non-invasive 3D proton-MR spectroscopic imaging of the *in vivo* human prostate at 3 Tesla without an endorectal coil

T. W. Scheenen[1], S. W. Heijmink[1], S. A. Roell[2], C. A. Hulsbergen-Van de Kaa[3], B. C. Knipscheer[4], J. O. Barentsz[1], A. Heerschap[1]; *[1]Radiology (667), Radboud University Nijmegen Medical Center, Nijmegen, The Netherlands, [2]Siemens Medical Solutions, Erlangen, Germany, [3]Pathology, Radboud University Nijmegen Medical Center, Nijmegen, The Netherlands, [4]Urology, Radboud University Nijmegen Medical Center, Nijmegen, The Netherlands.*

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