QRR005

A Software for Quantitative Liver DCE and DWI-MRI to Support Treatment Monitoring in Liver Cancer and Metastasis

All Day Room: QIRR, Learning Center

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BACKGROUND

Treatment of cancer, especially for advanced tumors or metastasis in the liver, can be supported by quantitative and accurate biomarkers to monitor treatment response. An increasing number of therapies based on different mode of action, ranging from chemo-, radiotherapy to local catheter based embolisation, is available. It is of high importance to monitor therapeutic effects early to change inefficient and expensive treatment early on. Several techniques in MRI, such as DCE and DWI, provide additional information reflecting lesion vascularization and cell density add additional information to the RECIST standard. Additionally, liver specific contrast agent can give information on treatment effects on the liver parenchyma to monitor side effects of the treatment.All these techniques require reliable preprocessing for motion and MRI sequence properties. Especially at 3T and higher field strength, the influence of the local flip angle variation B1 can strongly influence the result of the DCE biomarker parameters.Also, the radiologist should be supported with techniques facilitating the comparison of individual lesions in current and prior images in this multimodal environment.Therefore, we will present a software designed for follow up of liver MRI examination including the comparison of quantitative biomarkers from functional MRI. The software can include calibrations for T1 and B1 effects in DCE as well as perform motion correction in DCE and DWI-MRI.The software will be available in November 2016. It is a adaptation of the earlier presented software developed for lung cancer.The application is distributed to interested investigators, at no costs, as a binary installer for windows 7/8 64 Bit and for Mac OS X. It requires a short research proposal and a collaboration contract with our research institute.

METHODOLOGY/APPLICATION

The application presented is a demonstrator software for the comparison of measurements of DCE and DWI-MRI prior and after treatment and to supporting clinical trials. It combines CT, morphological, immunological and functional MRI to obtain and evaluate information on tumors and treatment response. The software uses B1 and T1 calibration measurements and motion correction into the calculation allowing an accurate and reproducible result. It also facilitates the linking of lesions in current and prior measurements.The application provides:-Advanced DCE-MRI and DWI using automatic motion correction in of the liver, either for breath hold axial images with low temporal resolution or for fast DCE-MRI acquired in the coronal or sagittal plane.-Semiautomated selection of the arterial and portal venous input as input for the general kinetic model (GKM) or for calibrating the contrast enhancement with the contrast agent intake.-Calculation of parameters for DCE (Ktrans, vi, AUCC and normalized CA concentration), DWI (ADC, F and D) and native T1 pre- and post contrast.-The use of B1 and T1 maps accounting for field and tissue properties.-Accurate alignment of functional and morphological data.-One click/one stroke segmentation of lesions.-Export of results into pdf-reports as well as excel table.

DEMONSTRATION STRATEGY

The visitors will be introduced to treatment options for liver tumors and metastasis in a powerpoint presentation and on a provided poster. The physiological background behind therapies and the related DCE or DWI biomarkers will be explained. The importance of calibration measurement such as T1 and B1 maps, especially at 3T and above, will be introduced. It will be discussed which DCE and DWI sequence can be fitted best into the clinical routine, e.g., using slow imaging vs with full coverage vs fast imaging of specific lesions. In a next step, it will be shown how the software can be used to:-import the required sequences and how to integrate them into the workflow.-select the correct dual input from aorta and portal vein for the modelling and normalization of DCE.-segment lesions in question and how to do a multi parameteric evaluation.-compare results for pre- and post treatment measurements.-export the results as pdf-report and in an automatically generated excel sheet.

REFERENCES AND PUBLICATIONS

[1] Gonzalez-Guindalini FD et al, 2013. Assessment of Liver Tumor Response to Therapy: Role of Quantitative Imaging. Radiographics. [2] Cunningham CH, et al, 2006. Saturated double-angle method for rapidB1+ mapping. MRM. [3] Laue et al., 2007. Softwaretools for Pharmacokinetic Modeling in the Analysis of DCE-MRI data. RSNA.[4] Ritter et al, 2011. Medical image analysis. IEEE Pulse. [5] Ng et al., 2010 Reproducibility of Perfusion Parameters in Dynamic Contrast- Enhanced MRI of Lung and Liver Tumors: Effect on Estimates of Patient Sample Size in Clinical Trials and on Individual Patient Responses. AJR.[6] Padhani et al, 2009. Diffusion-Weighted Magnetic Resonance Imaging as a Cancer Biomarker: Consensus and Recommendations. Neoplasia.

Meet-the-Experts Schedule:

Sunday 12:30pm - 1:30pm
Tuesday 12:15pm - 1:15pm
Wednesday 12:15pm - 1:15pm
Thursday 12:15pm - 1:15pm