AbstractID: 3635 Title: Tools for voxel-by-voxel correlation of radiotherapy dose and MR signals from multiple physiological/functional MRI modalities

Purpose: The use of multiple physiological/functional MR modalities for radiation therapy is limited by the lack of tools to correlate voxel-by-voxel MR signal with voxel-by-voxel dosimetric data. Developing such tools is the purpose of this work.

Method and Materials: We have developed a process and tools that enable the analysis of the data from multiple forms of MR based biological/functional imaging modalities along with the 3D dose distributions from a commercial radiation treatment planning system. Different types of images (CT and multiple MRs) are registered through commercial software (XIO CMS). A 4x4 registration matrix for the rotation and translation of coordinates is extracted from this software and used by our code written in MATLAB for interpolation of data from one coordinate system to another. The computational environment for radiotherapy research (CERR) served as the main platform for handling and visualization of data. We made additions and modifications to CERR to accomplish multiple secondary image –dose display and extraction of voxel-by-voxel registered information. This overall system of tools also has the capability of volumetric dose analysis, such as DVHs, and a voxel-based biological quantify, VED (Voxel uniform dose, similar to EUD except it is calculated in a voxel) can be obtained.

Results: The tools are being used in our institution in retrospective voxel-by-voxel analyses of radiation responses using various MR modalities, including relative cerebral blood volume (rCBV), Chemical shift imaging (CSI) and Diffusion Tensor Imaging (DTI).

Conclusion: In order to integrate multiple functional MR modalities into radiation therapy process (planning and outcome assessment), a necessary step is to understand the relationship between MR data and treatment responses. This requires voxel-by-voxel registration between multiple image datasets and voxel-by-voxel correlation between image data with radiation dose. The tools developed in this work serve this purpose.