

AbstractID: 3795 Title: From morphological to functional definition of organs at risk: the role of fMRI in radiosurgery

Purpose: functional magnetic resonance (fMRI) identifies areas related to different modality tasks. It is possible to identify particular areas in the brain which can be considered like “functional organs at risk” (fOARs). The aim of this study is to describe a method to exploit this functional information for the identification of fOAR in radiosurgery treatment planning.

Method and Materials: for a patient who underwent radiosurgery treatment, CT and 60 EPI MR volumes were acquired for BOLD analysis of functional areas. Tasks were chosen on the base of the lesion location. The functional maps obtained by Statistical Parametric Mapping (SPM) software refer to the template volume: if one wants to exploit this information for patient treatment, it is necessary to calculate the deformation field which maps the template onto the CT. Treatment planning was performed using the CyberKnife radiosurgery system.

Results: the method has been applied to a patient with a right frontal metastasis of breast cancer. We have performed BOLD analysis of the motor function with self-passed left hand and left foot tasks, and of language related areas using category generation task (CGT), letter generation task (LGT), and simple questions task (SQT). It has been found that the activation of the 2 motor tasks was very close to the lesion while for the CGT, LGT and SQT studies the most significant constraint deals with the language associative areas located in the dorso-lateral frontal cortex (Brodmann areas 8–9).

Conclusion: treatment plans studied with and without considering the fOARs were significantly different, in particular for the Dose Volume Histograms (DVH), while maintaining dose indices almost constant (homogeneity equal to 1.15 with fOARs and 1.18 without fOARs; conformity equal to 1 for both plans), proving a potential role of fMRI in radiosurgery.