AbstractID: 14308 Title: Simulating the growth of GBM using patient-specific DTI and FEC-PET data

Purpose: Patients diagnosed with glioblastoma multiforme (GBM), the most common and most aggressive brain tumor, continue to have very poor prognosis. Previous studies demonstrated that the tumor extent goes well beyond the gross tumor volume (GTV) visible on MRI. Reaction-diffusion models have proven effective in describing the growth kinematics of GBM beyond the visible GTV. However, these models make little use of patient-specific data, most of them using only patients MRI to distinguish the main brain structures. We developed a reaction-diffusion model which uses patients MRI as well as two other patient-specific imaging modalities: diffusion tensor imaging (DTI) and PET with [18F]-fluoroethylcholine (FEC).

Materials and methods: Twenty patients with a GBM diagnosis will be included in this study. Patients will receive standard radiotherapy plus temozolomide (chemotherapy) and will undergo three imaging sequences before, during, and after the six-week radiotherapy treatment. Each imaging sequence consists of standard MRI, DTI and PET with FEC. Patients will undergo subsequent follow-up MRI after treatment. In its current form, our reaction-diffusion model considers only one cell population. The diffusion coefficient is defined as the diffusion tensor calculated from DTI data and cell proliferation is assumed to be exponential. The model uses the finite element method to solve the diffusion equation on a two-dimensional 128x128 elements domain, corresponding to the resolution of the DTI data. FEC data is used to estimate proliferation rate and initial tumor concentration in the model.

Results: The recruiting of patients has just begun and patient-specific data were not available at the time of the abstract submission. Preliminary results using DTI from a healthy subject shows qualitative agreement with previously published models of GBM growth.

Conclusions: Our model simulated a realistic GBM growth using healthy subject data and is ready to incorporate patient-specific data as soon as such data become available.