

AbstractID: 14132 Title: Analyses of multiple q-sampled diffusion tensor amplitudes for pseudoprogressive GBM

Motivation: The current temozolomide (TMZ) concomitant with radiotherapy, can lead to earlier disruption of the blood-brain barrier (BBB) than the conventional radiotherapy alone. 1~2 months after concomitant radio-chemotherapy, the BBB disruption from the therapeutic response may be radiologically evidenced as an apparently progressive (i.e. pseudoprogressive) lesion. There are few convincing functional imaging studies, e.g. perfusion MRI, F-18 PET, that can clearly differentiate true tumor from pseudoprogressive one. The multiple-q-sampled diffusion tensor imaging (DTI) analyses, i.e. multiple “diffusion weighted echo-amplitudes” analyzed in q-space along the resolved diffusion characterized directions, can associate a certain diffusion population with diffusion spectral function of “q”. The **hypotheses** of this study: (1) large diffusive displacements with dispersive characteristic directions correspond to the BBB or edema area; (2) the range of anisotropic displacement becoming larger reflects deteriorating white matter (WM) glioma infiltration. **Method:** Each of 10 q-sampled-amplitudes (q : $0\sim 380\text{cm}^{-1}$) with 6 DTI-sensitized-directions is analyzed by 3D-ellipsoidal diffusion model. Then Eigen-values and Eigen-vectors for each of amplitudes sampled with various q-values are resolved by tensor diagonalization processes. **Results:** The DTI data sampled by q-value lower than 180cm^{-1} illustrates the averaged population over a wider diffusive range without anisotropic enhancement and the one higher q-value (e.g. $q>250\text{cm}^{-1}$) excluding larger displacement spectrum shows anisotropic specification. As scanned by conventional T2-weighted imaging or apparent-diffusion-coefficient mapping, GBM-brain images are overwhelmingly dominated by larger diffusive components and incapable of differentiating BBB from infiltrated WM. Our preliminary results show the multiple q-sampled DTI analyses can distinguish the regions of increasing diffusive displacements with dispersive diffusive directions (assuming BBB or edema) from the increasing secretion along WM fibers (assuming infiltrating WM). **Conclusion:** The spectrum of diffusive displacement are possibly differentiated by multiple q-sampled DTI, and this technique can be utilized for a better diagnosis and prognosis for GBM treatment studies or WM diseases.