AbstractID: 11647 Title: Multiple Aspects of Approximated-Returning-to-the-Origin Probability (ARTOP) Diffusion Tensor Imaging for Better Observation High-graded Gliomas Treatment Responses

Purpose: This study is to provide multiple aspects of physio-pathological information for early detecting cancer treatment responses and better clinical prognosis by using diffusion MRI modalities. The conventional *a*pparent *d*iffusion *c*oefficient (ADC) is known as a sensitive tool to detect early treatment responses. In this study, the diffusion weighting range is further extended and analyzed by novel *a*pproximated *r*eturning *t*o the *o*rigin *p*robability (ARTOP) for observing slow diffusion compartments for high graded gliomas. Reports had shown higher-graded gliomas correlating to slower water diffusing among the denser cells, the pathologically-recognized pseudopalisading necroses, caused by degenerating vessels in progressive gliomas in early stage. Furthermore, slower water diffusion also occurs as malignant gliomas infiltrate preferentially along myelinated fiber-tracks. **Method and Material:** The data were collected by Siemens Trio 3T magnet, and processed by 2nd order diffusion tensor with ARTOP q-space analysis developed by homemade MatLab-codes. The 5-minute echo-planar sequence with 2 averages for (~40 slices, 112x128 pixels per slice) is equipped by 9-level diffusion weighting (1~4k sec/mm^2), and each level is with 6-direction of diffusion tensor imaging (DTI) encoding. Data are gathered from three scans on non-resection Glioblastoma patients before, during and after radiation- and chemo-therapies. The imaging registrations were performed by rigid-body affine transformation. **Results:** ARTOP does not only clearly underline the slower-diffusing water signals (i.e. higher possibility at its origin), but it's also feasible for clinical routine unlike other q-space algorithms. So far, the newly migrating palisading glioma cells (as higher ARTOP and lower ADC) have been observed in the data of 3 out of 4 Glioblastoma patients. The increased extracellular spaces due to treatment illustrated as lower ARTOP, higher ADC, impaired fibers in fractional-anisotropy (FA) map with T2-weighting highlights all in one data set. **Conclusion:** The multi-face diffusion information, ARTOP-, ADC-, and FA-maps could suggest adaptive treatment in the future.