Lesional Diffusion Tensor Imaging-Derived Tensor Metrics From White Matter Tracts Of Different Grades Of Gliomas

Seow Pohchoo[1], Aditya Tri Hernowo[2], Vairavan Narayanan[3], Jeannie Wong Hsiu Ding[1], Nor Aniza Abdullah[4], Norlisah Ramli[1]

[1]Biomedical Imaging/ University Of Malaya/ Malaysia
[2]Surgery/ University Of Malaya/ Indonesia,
[3]Surgery/ University Of Malaya/ Malaysia,
[4]System And Computer Technology/ University Of Malaya/ Malaysia

Purpose
To investigate diffusion tensor imaging (DTI)-derived tensor metrics obtained from white matter (WM) tracts of the tumour regions for different grades of gliomas.

Materials and Methods
Twenty-four histologically proven glioma patients underwent a standard magnetic resonance (MR) imaging tumour protocol with DTI. The tumoural masks (intratumoural, peritumoural and tumour regions) were delineated using the snake model (ITK-SNAP) with reference to structural MR images. DTI processing and diffusion tensor fitting generated the DTI metric maps followed by tractography to delineate the WM tracts in tumoural regions. The mean values of DTI metrics (fractional anisotropy, mean diffusivity (MD), axial diffusivity (AD), radial diffusivity (RD), pure isotropic diffusion (p), pure anisotropic diffusion, total magnitude of diffusion tensor (L), linear tensor, planar tensor, spherical tensor and relative anisotropy) were obtained from mapping of the WM tracts of the tumoural regions onto the DTI metric maps.

Results
Significant differences were reported in few DTI metrics in the solid enhancing region (MD, AD, RD & p) and solid non-enhancing region (MD, AD, RD, p & L) across the WHO grades (grade II, III, and IV).

Conclusion
The WM tracts were not completely destroyed but were still intact inside the tumour, even glioblastoma, as opposed to the common belief that tracts are completely destroyed. DTI metrics provide insights on regional WM tract impairment in the vicinity of tumour while preoperative identification of WM tracts facilitates neurosurgical planning.