Multi-tensor tractography enables better depiction of motor pathways

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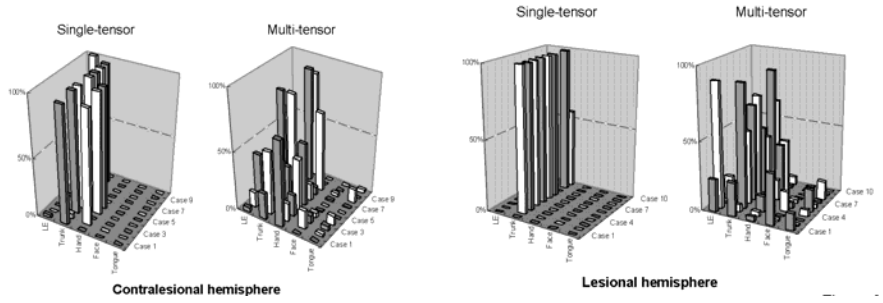
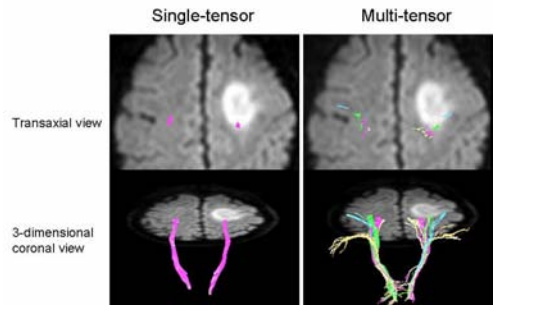
Background and Purpose - The depiction of the motor pathway using a conventional single-tensor tractography is usually limited to only part of the entire tract [1-2]. This limitation occurs because the information within a voxel is oversimplified to represent a fiber tract in a single direction. To overcome this issue, we applied multi-tensor analysis [3-5] for the diffusion-weighted imaging (DWI) data acquired for presurgical evaluation of brain tumor. The purpose of this study is to test the feasibility of using high angular resolution diffusion imaging (HARDI)-based multi-tensor tractography to depict motor pathways in patients with brain tumors.

Materials and Methods - Ten patients (6 males, 4 females) with a mean age of 52 years (range, 9-77 years) were scanned using a 1.5 Tesla clinical magnetic resonance (MR) unit. DWI were acquired using a 1.5 Tesla whole body scanner (Philips, Gyroscan *Intera* 1.5T). Single-shot echo-planar imaging was used for diffusion-weighted imaging (repetition time, 6000 ms; excitation time, 88 ms) with a motion-probing gradient in 32 orientations and a *b*-value of 1000 sec/mm^2. Data postprocessing was performed using both the conventional single- and multi-tensor methods. The depiction rate of the 5 major components of the motor pathways, that is the lower extremity, trunk, hand, face, and tongue, were assessed.

Results – Motor fibers on both lesional and contralesional sides were successfully depicted by both the single- and multi-tensor techniques. However, with the single-tensor model, the depiction of motor pathways was typically limited to the fibers of trunk areas. With the multi-tensor technique, at least 4 of 5 major fiber bundles arising from the primary motor cortex could be identified.

Conclusion - HARDI-based multi-tensor tractography using a standard b-value (1000 sec/mm^2) can depict the fiber tracts from the face and tongue regions of the primary motor cortex.





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The paper has been submitted to *Radiology* for review.