

Protocol for Preoperative Subcortical Mapping with Fiber Tracking with Diffusion Tensor Imaging for Tumors in Eloquent Areas

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Learning objectives

To describe seeding ROIs to reproduce the language fascicles separately for preoperative mapping with DTI tractography.

Background

Tractography mapping for subcortical white matter fibers is nowadays worldwide available. However, a clear protocol for reconstruction of each fascicle separately has not been described yet.

Findings and procedure details

Methods:

20 control studies were performed with a 3.0-Tesla resonator and 20 control studies were performed with a 1.5-Tesla resonator. Axial and coronal tensors, as well as volumetric T1 sequences were acquired. 2D and 3D ROIs were used to find adequate reconstruction of each fasciculus.

Results:

ROI of the Arquate fasciculus (Coronal): The average radius is 4.0mm, the location was subcortical frontal, above the upper corner of the insula. (Figure 2)

ROI of the Uncinate fasciculus (Coronal): the average radius is 2.0mm, the location was subcortical temporal, at the beginning of the temporal stem at the junction of tracts of T1 and T2 temporal lobe areas. (Figure 3)

ROI of the Inferior Fronto-occipital fasciculus (Coronal): The average radius is 2.0mm, the location was subcortical temporal in the medial aspect of the temporal stem. (Figure 1)

Inferior Longitudinal Fascicle ROI (Coronal): The average radius is 4.0mm, the location was temporo-occipital subcortical periventricular, it is also possible to reconstruct it in the junction of fibers coming from the T4 and T5 temporal areas. Reconstruction of fasciculi are illustrated with clinical cases.

ROI of the Superior Longitudinal Fasciculus (Axial): The average radius is variable, depending of the subsegment desired. Adequate differentiation from the arcuate fasciculus was achieved.

Images for this section:

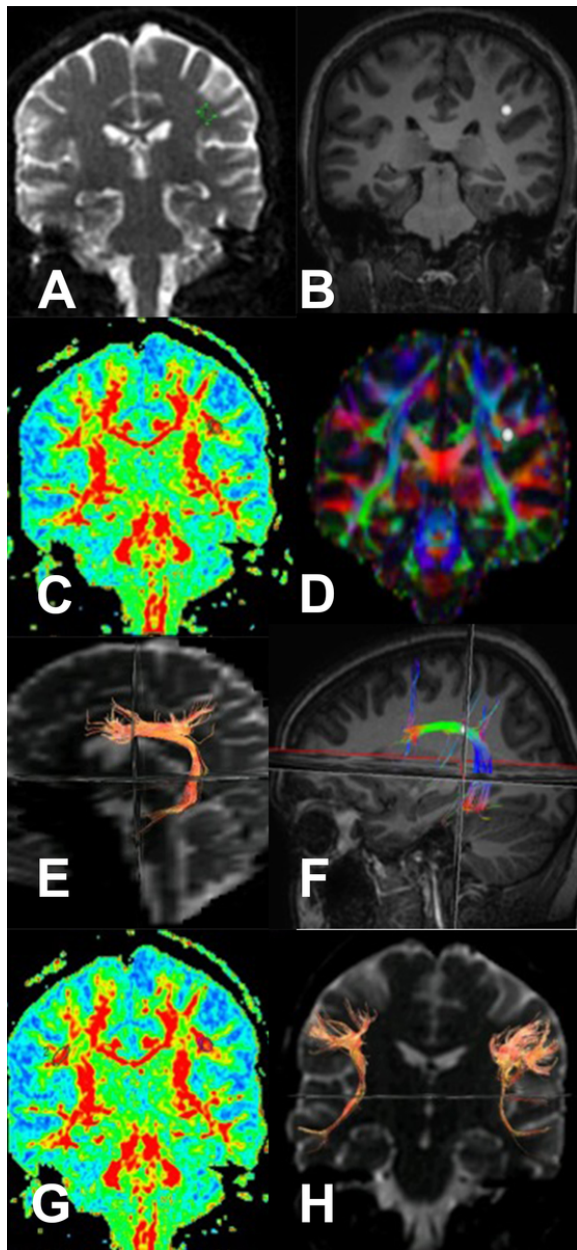


Fig. 2: Figure 2. Reconstruction with tractography of the arcuate fascicle. In the column on the left, reconstruction is observed with 1.5 Tesla and to the right with 3.0 Tesla. (A and B) Coronal sections of the tensor and of T1, respectively, showing the location of the ROI in the aspect superior to the insula. (C and D) Coronal sections of the fractional anisotropy maps are observed. (E and F) Three-dimensional reconstruction of the arcuate fascicle. (G and H) The placement of the ROIs and the 3D reconstruction of the tract of the arcuate fasciculus were observed bilaterally.

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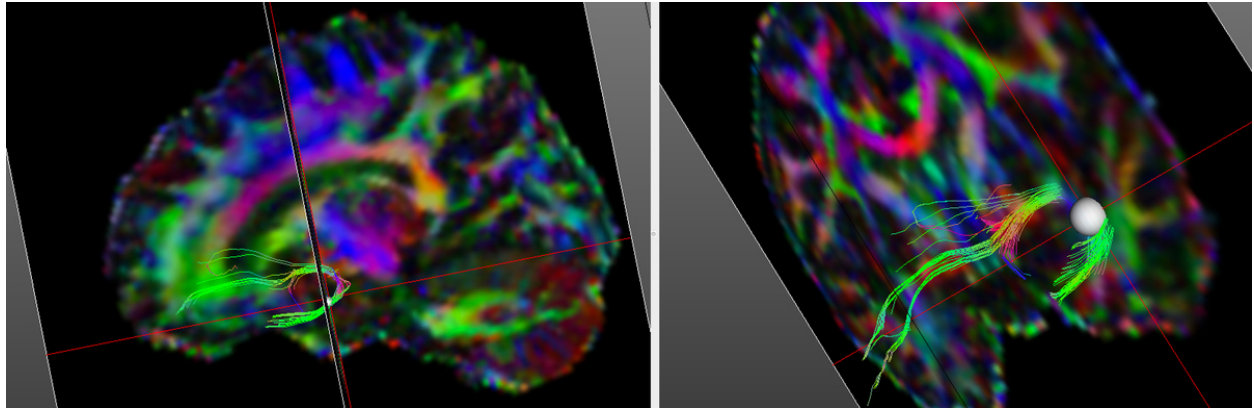


Fig. 3: Figure 3. 3D reconstruction of the Uncinate Fasciculus. Images processed with Braviz.

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Conclusion

Key points for ROI selection are illustrated and suggested for reconstruction of each language fasciculus separately. This protocol was successfully reproduced with tensors obtained with 1.5 and 3.0 Tesla resonators.

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