

Peripheral Nerve Diffusion Tensor Imaging

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Introduction

MR diffusion tensor imaging with fiber tracking is a relatively new technique used in the central nervous system. However, to our knowledge no fiber tracking has been performed on the peripheral nervous system yet, mainly because of the inherent susceptibility to motion, field inhomogeneities and fast T2-relaxation of the diffusion imaging technique.

Material and methods

The study was performed on a 1.5 Tesla Intera MR-scanner (Philips Medical Systems, Best, the Netherlands) used for clinical examinations. The examined volume was a 15 cm distance of the proximal left thigh on 3 healthy subjects. A 2-channel phased-array coil (Flex-M) was used.

Diffusion imaging was performed in the axial plane with a single shot diffusion weighted EPI sequence, a b-value of 400 s/mm² in 32 diffusion encoding directions plus a reference image without diffusion weighting (TE=70 ms, TR=4 s, SLTH=6 mm, 25 slices, FOV=24x24 cm, 96x96 matrix). T2 weighted imaging in the axial plane was performed for anatomical reference.

Fiber tracking was performed with an IDL-based (Research Systems INC., Boulder, USA) fiber tracking program (PRIDE) provided by Philips. Fiber tracking constraints was made with two ROIs placed surrounding the expected anatomical place for the sciatic nerve in two axial slices (figure 1). Largest fiber deviation in one step was 9.4°, minimum fiber length was 80 mm, with a step size of 0.5 voxel. Anisotropy threshold was set to 0.3.

Results

In all 3 subjects fiber tracking of the diffusion tensor images detected a bundle of fibers. For anatomical comparison T2 weighted images were used. The location of the fibers correlated to the sciatic nerve (figure 2), deviation of fibers at the top is due to poor signal at the coils peripherals.

Discussion

To our knowledge there has not been any published data on diffusion tensor imaging with fiber tracking of peripheral nerves. In this study, however, this technique was used to detect the sciatic nerve.

Though the fibers were detected in all 3 subjects the contribution of noise was substantial. Therefore further investigations needs to be done to improve the SNR and to see if smaller peripheral nerves than the sciatic nerve can be detected. If so, one may in the future expect clinical indications for peripheral diffusion tensor imaging with fiber tracking. Three interesting indications to be investigated would be diagnostics of peripheral nerve derived soft tissue tumours, nerve entrapment and traumatic plexus injuries.

Conclusion

Though inherent susceptibility to motion, field inhomogeneities and fast T2-relaxation of the diffusion imaging technique the sciatic nerve could be detected with diffusion tensor imaging and fiber tracking.

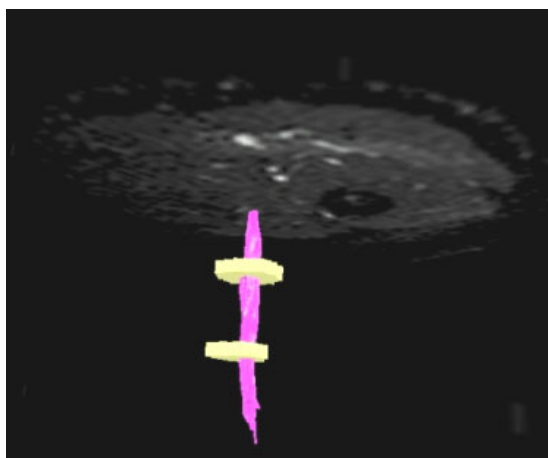


Figure 1.

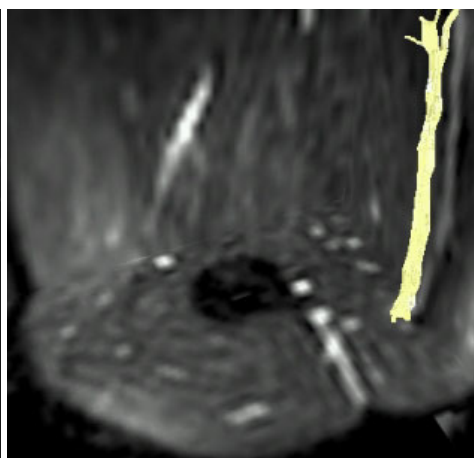


Figure 2.