Diffusion Tensor Imaging Characteristics of Normal Human Cervical Spinal Cord at 3T [Presidential Award Proceedings]

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Background and Purpose : Recent advancement in magnetic resonance (MR) imaging technology has allowed acquisition of high resolution diffusion tensor imaging with reduced field-of-view MR imaging (rFOV-DTI). We attempted to identify the DTI characteristics of the normal human cervical spinal cord using rFOV-DTI.

Methods : All examinations were performed using a 3-tesla MR imaging scanner. Forty-three normal subjects (21 men, 22 women, aged 24 to 68 years) underwent rFOV-DTI using parameters : repetition time (TR), 2219 ms ; echo time (TE), 81 ms ; FOV = 60 × 32 mm ; pixel size = 0.8 × 0.8 mm ; b = 1000 s/mm^{-2} ; number of diffusion gradient directions = 6 ; and axial plane. We evaluated the major DTI indices-fractional anisotropy (FA), mean diffusivity (MD), and parallel ($\lambda_{//}$) and perpendicular diffusivity ($\lambda_{\perp}$) values-for each component and vertebral level of the cervical spinal cord.

Results : FA, MD, and $\lambda_{\perp}$ varied significantly among the white matter columns. The posterior column had the largest FA and smallest MD and $\lambda_{\perp}$ values, whereas the anterior column had the smallest FA and largest MD and $\lambda_{\perp}$ values. $\lambda_{//}$ did not differ significantly among the white matter columns. FA tended to decrease and $\lambda_{//}$ and $\lambda_{\perp}$ tended to increase with descending cervical vertebral level. There were also gender- and age-related variations in the absolute values of the major DTI indices.

Conclusions : Quantitative values of the major DTI indices vary among the components and vertebral levels of the cervical spinal cord. Normative values are necessary in interpreting the major DTI indices. rFOV-DTI allows quantitative assessment of the major DTI indices of normal human cervical spinal cord, which reflects the cord's histological nature.

Keywords : DTI, normal human cervical spinal cord
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