NORMAL REGIONAL FRACTIONAL ANISOTROPY AND APPARENT DIFFUSION COEFFICIENT OF THE BRAIN ON 3T

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Introduction:

Diffusion tensor imaging (DTI) has seen increased usage in clinical and basic science research in the past decade. Its quantitative nature enables objective diagnosis and monitoring of diseases, especially in drug evaluation studies or multi-site studies [1,2]. In DTI, the use of at least one base image and six diffusion-weighted images along non-collinear encoding directions enables eigenvectors to be calculated. Fractional anisotropy (FA) maps and apparent diffusion coefficient (ADC) maps can then be computed. We now attempt to provide data on the normal reference range of FA and ADC in 20 different regions of the normal brain, by measuring FA and ADC values in adult volunteers, to serve as a baseline for future comparison studies.

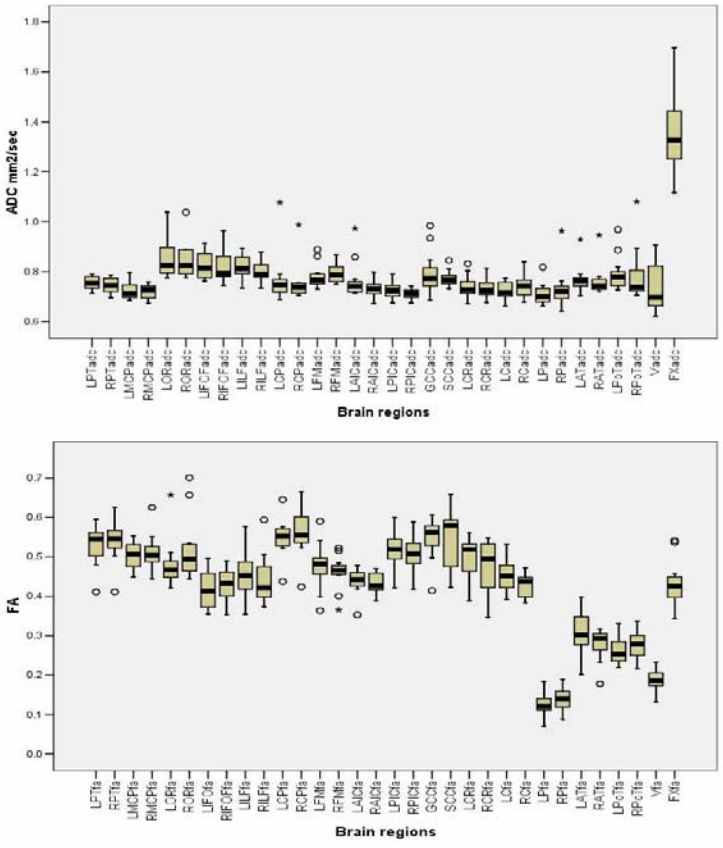
Method:

12 healthy volunteers (mean age 40 years, range 21-60) were imaged under an IRB approved protocol, on a 3.0T MR system (Philips Intera with SENSE head coil, software release 6.1.5; Philips Medical Systems, Best, The Netherlands). Diffusion tensor MR imaging was performed using a single-shot, spin echo, echo planar DTI sequence. 32 directions (max b factor= 1000) were used. Matrix = 128 x 128; FOV = 240mm; slice thickness 2.5 mm; TR = 6000 ms; TE = 76 ms; no. of averages = 1; acquisition time = 3:36 min. The study was repeated 3 times, and registered to 1 set of data set using Philips PRIDE tool. Fractional anisotropy (FA) and apparent diffusion coefficient (ADC) maps were generated using Philips PRIDE tool on a personal computer. 20 different regions of interest (ROI) were drawn on the color maps, with left and right ROI statistics measured separately.

Results:

We have produced a table of normal values of FA and ADC for 20 regions of the brain. The fractional anisotropy is the highest for the corpus callosum followed by the cerebral peduncle, related to the tight packing of the fibers in these regions. The deep nuclei, on the other hand, show much lower FA, as would be expected. The ADC, in general, shows little variation in the brain, except for the fornix. Our data are comparable to other published data.

Brain Region (left and right combined)	FA mean ± sd	ADC mean ± sd
Pyramidal tract (LPT / RPT)	0.47 ± 0.05	0.75 ± 0.03
Vermis (V)	0.19 ± 0.03	0.68 ± 0.23
Middle cerebellar peduncle (L/RMCP)	0.51 ± 0.04	0.72 ± 0.03
Optic radiation (L/ROR)	0.46 ± 0.10	0.85 ± 0.08
Inferior fronto-occpital fasiculus (L/RFOF)	0.42 ± 0.05	0.83 ±0.06
Inferior longitudinal fasiculus (L/RILF)	0.44 ± 0.06	0.81 ± 0.04
Cerebral peduncle (L/RCP)	0.55 ± 0.05	0.74 ± 0.16
Optic tract (L/ROP)	0.31 ± 0.08	1.48 ± 0.45
Forceps minor (L/RFM)	0.46 ± 0.04	0.79 ± 0.04
Anterior limb of internal capsule (L/RAIC)	0.43 ± 0.03	0.75 ± 0.05
Posterior limb of internal capsule (L/RPIC)	0.50 ± 0.04	0.72 ± 0.02
Fornix (Fx)	0.43 ± 0.06	1.35 ± 0.16
Genu of corpus callosum (GCC)	0.54 ± 0.05	0.74 ± 0.21
Splenium of corpus callosum (SCC)	0.54 ± 0.07	0.77 ± 0.03
Putamen (L/RP)	0.13 ± 0.03	0.72 ± 0.06
Globus pallidus (L/RGP)	0.20 ± 0.06	0.75 ± 0.13
Anterior thalamus (L/RAT)	0.29 ± 0.05	0.76 ± 0.06
Posterior thalamus (L/RPoT)	0.27 ± 0.03	0.79 ± 0.09
Corona radiata (L/RCR)	0.48 ± 0.04	0.74 ± 0.04
Cingulum (L/RC)	0.43 ± 0.04	0.73 ± 0.04



Conclusions:

We have produced a table of normal FA and ADC in the brain in 20 different regions of the brain. This will serve as a baseline and reference for future DTI studies in the brain.

References:

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