Presentation 10 - Roddy McColl

DTI Sub-Core: Imaging Protocol and Prelim Data

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DTI: Motivation

- Possible involvement of white matter in one or more of the syndromes.
- Recent literature (sarin attacks) indicates FA changes in brainstem of victims.
- Both focal and diffuse WM changes possible given GWS symptoms.

FA reduction in sarin victims (Ann Neurology, 2006)

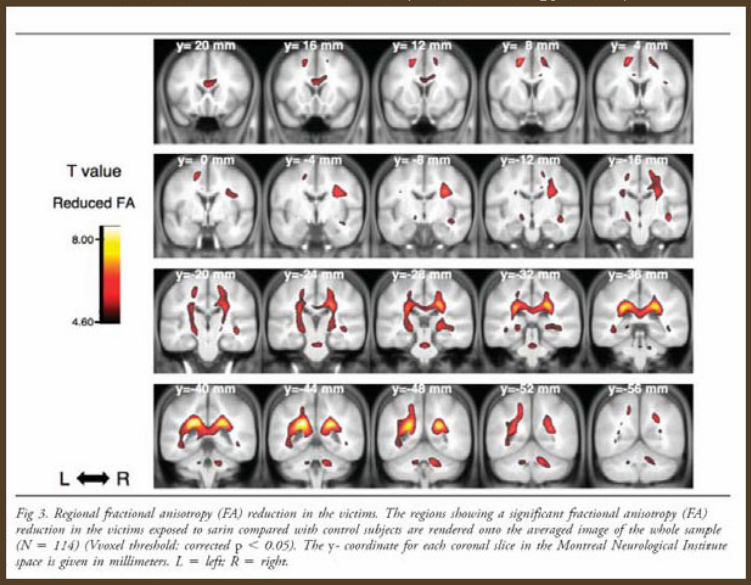


Fig 3. Regional fractional anisotropy (FA) reduction in the victims. The regions showing a significant fractional anisotropy (FA) reduction in the victims exposed to sarin compared with control subjects are rendered onto the averaged image of the whole sample (N = 114) (Voxel threshold: corrected p < 0.05). The y- coordinate for each coronal slice in the Montreal Neurological Institute space is given in millimeters. L = left; R = right.

Prelim Brainstem Studies (1.5T)

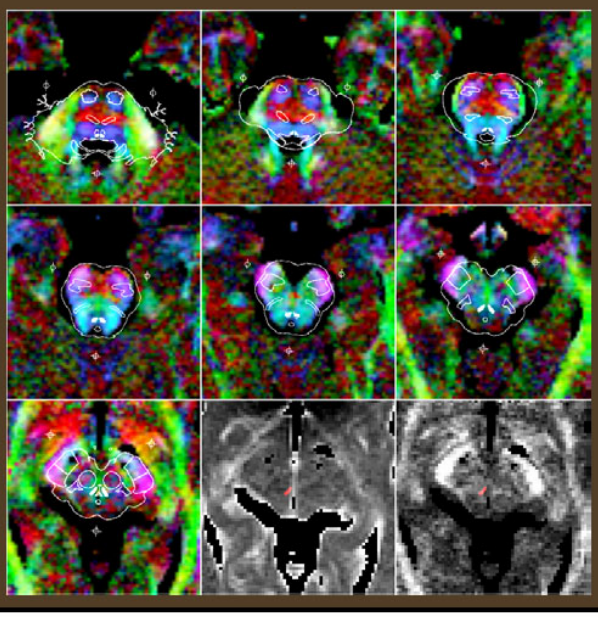
- Cohort: Multiple Sclerosis
- Brainstem DTI scanning (1mm in-plane, 4mm slice)

McColl, Frohman, Swaminathan, Frohman. AAN, 2005.

INO in MS implicates the MLF (CN3-CN6)
MLF not visible

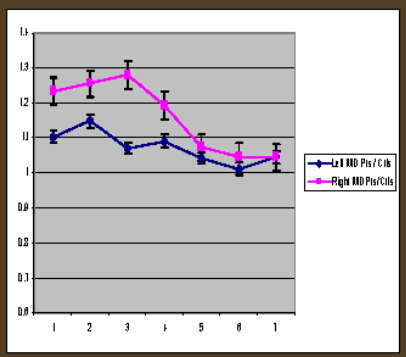
GE 1.5 T.
25 drns, 2 b=0.
1.0x1.0x4.0mm,
NEX=3.

Atlas-registered BS sections to highlight MLF.

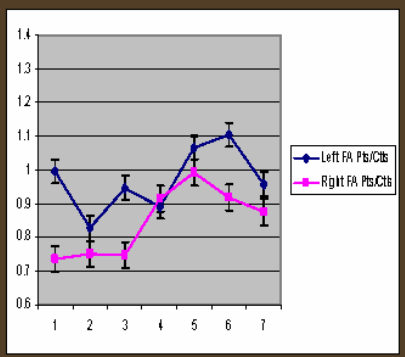


McColl, Frohman, Swaminathan, Frohman. AAN, 2005.

MD: MS Patients > Controls



FA: MS Patients < Controls

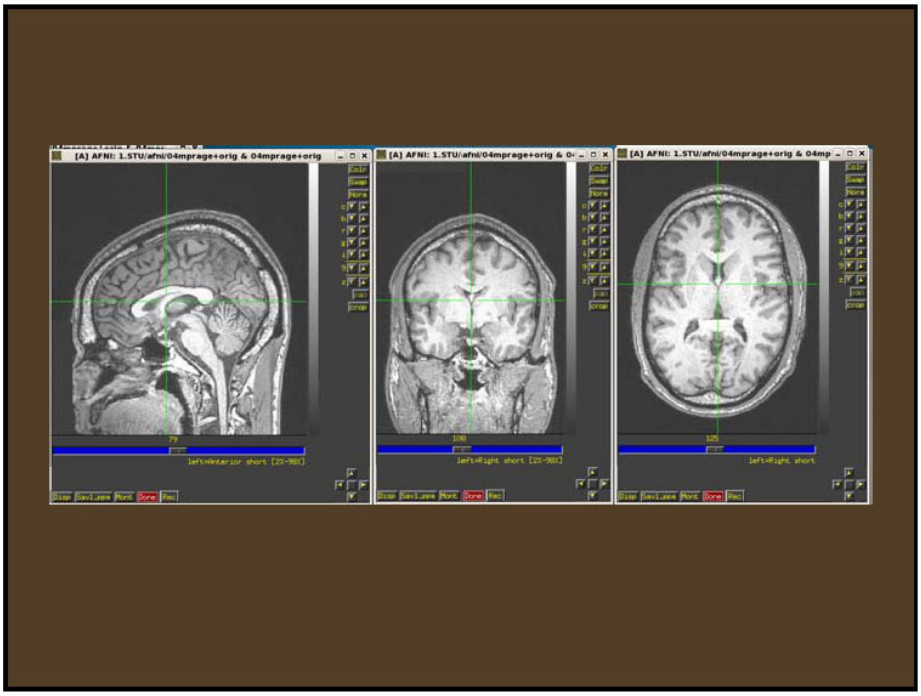


DTI: Imaging Goals

- Obtain sufficient data for global and local analyses with a 30 minute imaging session.
- Plan to include a global coverage scan with parameters suitable for tract analyses and other whole brain information.
- Plan to include a high in-plane resolution scan of the brainstem for in-depth interrogation of this region.
- Obtain enough data to support other models of diffusion than the 3x3 tensor.

Imaging Protocol

- Obtain in 5 minutes a high-quality T1 volume scan e.g. MP-RAGE

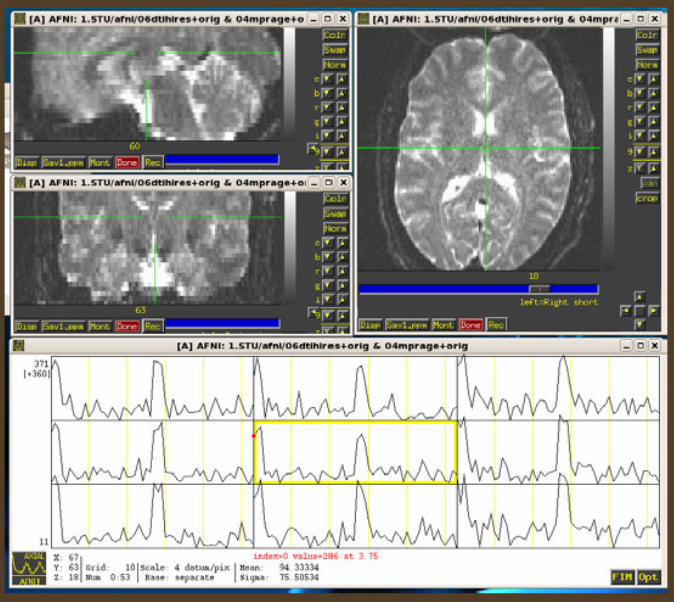


Imaging Protocol

- Obtain a 2x2x2 mm DTI scan with 24 directions at b=1000 and 3 b=0 sets (1:8 unweighted/weighted ratio)

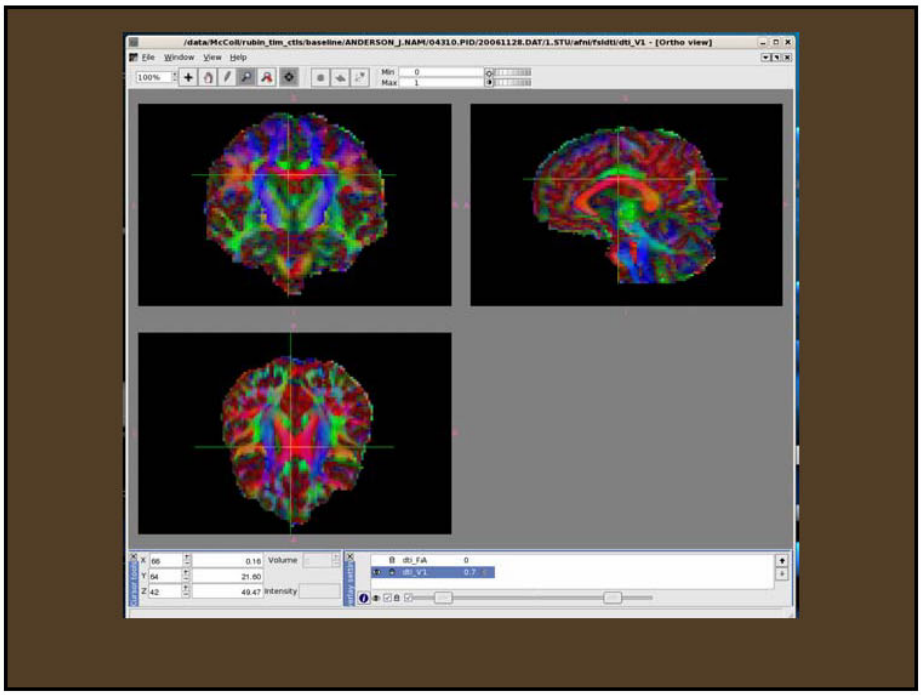
Imaging Protocol

- Obtain a high in-plane resolution DTI sequence of the brain stem (1mm in-plane, 3mm slice) with 24 directions at b=1000 and 3 b=0 images. Due to lower SNR from smaller voxel, this is repeated twice.



Analysis Protocol

- We will use the FSL imaging toolkit developed by Oxford University Functional Imaging Laboratory.
- Toolkit include software for: eddy current correction/bulk motion, tensor fitting to the data, tractography, group analysis of white matter.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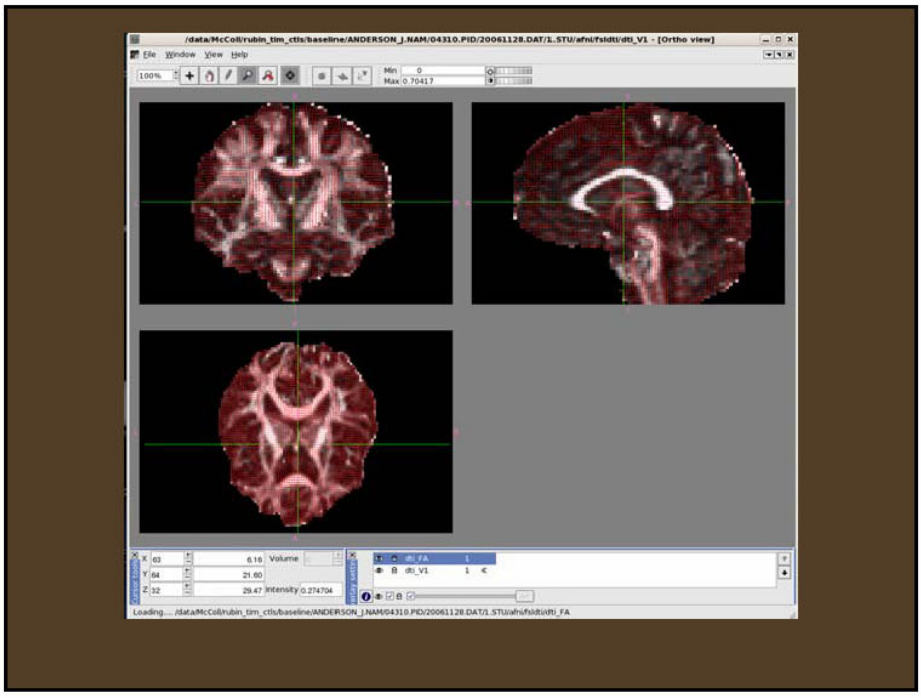
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Pilot Study Notes

- Adult male, all series acquired within 30 minutes.
- Analyses time requirements: Are likely to evolve, currently approximately 1-2 hours of computation for eddy-current correct. Dti fit is rapid. Group analyses are more compute intensive (need to find “best” WM map, NP-complete problem).