



Validation of diffusion MRI estimates of compartment size and volume fraction in a biomimetic brain phantom using a human MRI scanner with 300mT/m maximum gradient strength

Purpose

To validate diffusion microstructural imaging methods that can standardize MRI protocols within neuroimaging research.

Participants

Phantoms filled with distilled water that simulate human white matter.

How was the study conducted?

All phantoms were scanned with a high-gradient 3T CONNECTOM MRI system. The simulated data was created by the Monte Carlo diffusion simulator and analyzed by q-sampling imaging, AxCaliber approach, Markov chain Monte Carlo, and Rician noise model

Findings

Study validated diffusion MRI metrics using a phantom that was analogous to both intra and extra-axonal spaces on a human scanner. Compartment size and volume fraction were validated, and therefore this phantom can be used in other simulation experiments.

Military Impact

Phantoms that can mimic the human brain become useful in experiments where in-vitro methods are too risky. This study helps advance the neuroimaging techniques for studying brain changes following TBIs in Veterans and service members.

Fan, Q., Nummenmaa, A., Wichtmann, B. Witzel, T., Mekkaoui, C., Schneider, W., Wald, L., & Huang, S. (2018). Validation of diffusion MRI estimates of compartment size and volume fraction in a biomimetic brain phantom using a human MRI scanner with 300mT/m maximum gradient strength. NeuroImage, 1-10.