Improved Phantom for Quantitative Diffusion MRI

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WARF: P150322US01

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in novel phantoms for q-dMRI techniques.

Overview

Among numerous magnetic resonance imaging contrast mechanisms, the insights that diffusion-weighted MRI provides into microstructural tissue changes make it an excellent biomarker for detection and evaluation of necrosis, infection, fibrosis and cancer. Yet to realize its true diagnostic potential it is vital to develop quantitative diffusion MRI (q-dMRI) techniques that enable accurate, robust and reproducible measurements of diffusivity (or apparent diffusion coefficient, ADC). This would create tremendous opportunities in tumor characterization and treatment monitoring.

For q-dMRI to become a valid biomarker, validation of its accuracy and reproducibility is critical. Existing and proposed phantoms do not meet all desired criteria. Still needed are phantoms that exhibit desirable MR spectra, diffusion decay profiles and ADC values spanning the entire range of biological tissues under various physiological conditions and environments.

The Invention

UW–Madison researchers have developed a q-dMRI phantom with advantageous properties, including single-peak MR spectrum and Gaussian diffusion propagation. By varying the combined concentration of solvent (e.g., acetone) and solute (e.g., deuterium oxide or diacetyl), the diffusivity of the solution can be controlled to fall within a range of values found in a variety of biological tissues in different physiological conditions and environments.

Under temperature-controlled conditions (for example, submerging the phantom in an ice-water bath) the phantom can reproducibly exhibit ADC values that cover the entire physiological range. Furthermore, different types of paramagnetic salts may be added into the mixture to control T1 and T2 relaxation of the phantom.

Applications

- Controlled testing and quality assurance of q-dMRI techniques
- Quantitative diffusion imaging protocols are most commonly used for treatment monitoring and staging of metastatic cancer.

Key Benefits

- Exhibits single-peak MR spectrum
- Gaussian diffusion propagation
- Can reproducibly exhibit ADC values across wide physiological range

Stage of Development

Validation data and demonstrated accuracy.

Additional Information

For More Information About the Inventors

- Scott Reeder
- Diego Hernando Arribas

Related Technologies

- See WARF reference number P150328US01 for information about the researchers' improved phantom for iron and fat quantification MRI.

Publications

- Wang X., Reeder S.B. and Hernando D. 2017. An Acetone-Based Phantom for Quantitative Diffusion MRI. J Magn Reson Imaging. 46, 1683-1692.

Tech Fields

- Medical Imaging : MRI

For current licensing status, please contact Michael Carey at mcarey@warf.org or 608-960-9867