Magnetic Resonance Imaging Diffusion Weighted Preparatory Sequence to Remove Patient Motion Effects

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method and MR pulse sequence that provides a diffusion-weighted NMR signal acquisition MR pulse sequence that is not sensitive to patient motion.

Overview

Magnetic resonance imaging (MRI) is used to measure nuclear magnetic resonance (NMR) from various substances in human tissue to produce medical images for qualitative and quantitative assessments. These various substances in human tissue emit NMR by when a magnetic field is applied at a frequency specific to that substance. Depending on the area of interest, different techniques are used to measure and image the NMR from different substances.

Diffusion-Weighted Imaging (DWI) is a useful MRI technique for the probing of microscopic tissue structures. DWI uses a pulse sequence with special diffusion gradients that allow the detection of NMR signals from water diffusion in the tissue. The MR signal intensity decreases with the speed of water diffusion, which is directly related to tissue density and can be used for imaging. However, DWI is extremely sensitive to patient motion because it uses multi-shot methods for acquiring multiple data sets.

Echo Planar Imaging (EPI) is a high signal-to-noise solution that captures data in an ultra-rapid single shot to ensure patient motion does not affect the image. However, EPI results in poor spatial resolution, severe distortion in areas of high magnetic susceptibility and ghosting artifacts and requires high performance hardware.

The Invention

UW–Madison researchers have developed an improved preparatory DWI technique that removes the effect of patient motion. Specifically, the method uses a MR pulse sequence that provides diffusion-weighting to NMR signals without sensitivity to patient motion. An initial pulse sequence is performed prior to the imaging pulse sequence that diffusion weights the spin magnetization moment of the water molecules. The initial pulse sequence uses a gradient waveform that removes all the distorting phase shifts resulting from velocity motion of the tissue. However, the phase shifts due to higher order motion such as accelerations and other motions characteristic of diffusing spins are not removed. Therefore, DWI can be used at the area of interest without the effects of patient motion.

Applications

- General DWI applications
- Early detection and characterization of cytotoxic edema
- Tumor characterization
- Cerebral tractography for fiber angle mapping of cerebral white matter
- Liver imaging

Key Benefits

- Removes distortion and image artifacts due to patient motion
- Allows for higher spatial resolution than conventional EPI techniques
- Does not require high performance hardware needed for EPI techniques

Additional Information

For More Information About the Inventors

- Scott Reeder

Tech Fields

- Medical Imaging : MRI

For current licensing status, please contact Jeanine Burmania at jeanine@warf.org or 608-960-9846