Method for Quantification of R_2 Relaxivity in Magnetic Resonance Imaging

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WARF: P110135US01

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method for measuring transverse relaxation rate (R_2*) corrected for confounding factors.

Overview

Mapping of effective transverse relaxation rate (R_2*) relaxivity has important applications in magnetic resonance imaging (MRI) including blood oxygenation level dependent functional imaging, detection and tracking of superparamagnetic iron oxides and assessment of iron content in the brain, heart, pancreas and liver. Measurement of hepatic iron content (HIC) is important for detection and quantification of iron overload. R_2* has been shown to be strongly correlated to HIC.

Mapping of R_2* in MRI can be performed from a set of gradient echo images acquired with different echo times. Measurements of R_2* are affected by several confounding factors. These confounding factors generally make R_2* maps dependent on the data acquisition parameters and may lead to misdiagnosis. A method for accurate measurement of R_2* is needed that corrects confounding factors and is independent of data acquisition parameters and specific MRI system hardware.

The Invention

UW–Madison researchers have developed a method for measuring R_2* with MRI in which signal decays that occur as a result of macroscopic variations in the main magnetic field of the MRI system are incorporated into a chemical-shift based signal model. The model provides for the mitigation of errors due to macroscopic field variations and allows better signal-to-noise ratio performance compared to existing R_2* measurements.

The method samples echo signals occurring at different echo times to acquire MRI image data. For each of the echo signals, a signal model is formed to account for relative signal components for each different chemical species, such as water and fat. Magnetic field inhomogeneity values associated with the MRI system are estimated by fitting the acquired image data to the signal models. This allows the creation of signal models that account for relative signal components for each different chemical species and signal decay resulting from macroscopic variations in the main magnetic field of the MRI system. The method also allows estimation of R_2* for at least one of the chemical species by fitting the acquired image data to the signal models.

Applications

- Diagnostic MRI including non-invasive assessment of hepatic and cardiac iron

Key Benefits

- Allows accurate quantification of R_2* relaxivity
- Accounts for confounding factors
- Improves signal-to-noise performance

Additional Information

For More Information About the Inventors

- Scott Reeder
- Diego Hernando Arribas

Related Technologies

- For information about a method for improved water-fat signal separation in MRI imaging, see WARF reference number P090389US01.

Publications

- Hines et al. 2011. T(1) Independent, T(2) (*) Corrected Chemical Shift Based Fat-Water Separation with Multi-Peak Fat Spectral Modeling Is an Accurate and Precise Measure of Hepatic Steatosis. J Magn Reson Imaging. 33, 873-881.
- Hernando D., Vigen K.K., Shimakawa A. and Reeder S.B. 2012. R2* Mapping in the Presence of Macroscopic B0 Field Variations. Magn Reson Med. 68, 830-840.

Tech Fields

- Medical Imaging : MRI

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