Magnetic Resonance Imaging of Diffusion and T_2 Using Multi-Echo Projection Acquisition

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Inventors: Sean Fain, Walter Block, James Holmes, Rafael O'Halloran

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method for simultaneously imaging the ADC and T_2* with a single patient breath-hold using only one hyperpolarized gas contrast agent dose in the lungs or other body airspace.

Overview

Magnetic resonance imaging (MRI) systems apply a magnetic field to excite the proton nuclei in human tissue, which then emit a nuclear magnetic resonance (NMR) signal. This signal is received by the MRI system, processed and reconstructed into an image using one of many techniques. MRI technology can be used to assess the viability of tissue for the diagnosis of diseases such as emphysema in the lungs.

One method utilizes hyperpolarized gases, which are noble gases that have been put in a hyperpolarized state, as contrast agents. After a hyperpolarized gas is administered to an airspace within the human body, such as the lungs, diffusion weighted imaging (DWI) uses MRI technology to apply special magnetic field gradients to measure the diffusion of the gas into the lung airspaces. From the diffusion weighted images, a measurement called the apparent diffusion coefficient (ADC) can be used to create 3D parametric images of the level of diffusion restriction. These images are used for diagnosis since the hyperpolarized gases will diffuse less when they are restricted by the tissue microstructure and will show a different microstructure in diseased areas, such as in the case of emphysema or small airways disease.

Mapping the apparent transverse relaxation (T_2*) of a proton species also proves useful in assessing tissue viability and diagnosing disease. The T_2* mapping uses a multi-echo technique that requires multiple image acquisitions when used in the lungs. Each image is acquired during subsequent breath-holds of the patient. However, T_2* has been shown to be highly dependent on how much the lung inflates. Therefore, controlling lung volume during the acquisition by normalizing to total lung capacity would either reduce variability, or allow the use of these phenomena to evaluate the different degrees of inflation.

The Invention

UW-Madison researchers have developed a method for simultaneously imaging the ADC and T_2* in a single breath-hold with only one hyperpolarized gas contrast agent dose in the lungs or other body airspace. The method uses a multi-echo projection acquisition based pulse sequence that varies the inter-echo spacing and the diffusion weighting to successfully separate the effects of diffusion and T_2* decay in the MR signals. This separation improves the reliability of the measurements for ADC and T_2* to allow for single breath-holds to be used. The use of one breath-hold also reduces the required contrast agent dose to just one.

Applications

- Simultaneous DWI using a hyperpolarized gas and T_2* mapping for diagnosis of diseases such as emphysema in the lungs, or other body airspaces

Key Benefits

- Able to simultaneously image diffusion and T_2* decay
- Requires only one patient breath-hold for reliable results
- Reduces hyperpolarized gas dose down to one

Additional Information

For More Information About the Inventors

- Sean Fain
- Walter Block

Tech Fields

- Medical Imaging : MRI

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