UNIVERSITY OF MINNESOTA
Driven to Discover℠

In Vivo Measurement of ATP Hydrolysis (20130111, Dr. Jianyi (Jay) Zhang)

IP Status: Issued US Patent; **Application #:** 14/175,518

ATP hydrolysis rate determined without quantifying inorganic phosphate

This technology is a new magnetic resonance spectroscopy-magnetization saturation transfer (MRS-MST) pulse sequence implemented in software that provides the ability to measure adenosine triphosphate (ATP) hydrolysis rate in vivo. It is a double-saturation 31P MST protocol that uses inversion-recovery data and spectral data to measure ATP hydrolysis rate without requiring quantification of inorganic phosphate levels. By eliminating the need to quantify inorganic phosphate (Pi, 31P), this technology overcomes the primary barrier in determining the ATP turnover rate in vivo. The method will help basic science researchers investigate the energetic foundation of the function and dysfunction of certain organs and tissues. Clinically, it may be used to grade tissue function, to grade the severity of certain heart diseases (e.g. myocardial infarction) and evaluate stem cell treatments and other therapies with high spatial resolution.

Measure of cardiac tissue function

It has been speculated that decreased myocardial ATP production may contribute to cardiac dysfunction. However, accurate measurements of myocardial ATP turnover rates could never be examined in vivo. Magnetic resonance spectroscopy-magnetization saturation transfer (MRS-MST) has been extensively used for more than a decade to measure the ATP flux via creatine kinase (CK) in myocardial tissue. However, MRS-MST has generally not been successful in vivo in large animal models because the products of ATP hydrolysis (ADP and Pi) are at levels too low to be accurately measured. This new MRS-MST method can calculate the ATP hydrolysis rate in vivo in humans. It allows ATP hydrolysis rate to be measured in organ systems where inorganic phosphate levels are difficult to quantify.

Phase of Development

- Demonstrated on 9.4T pre-clinical research MRI (Magnetic Resonance Imaging) system.

Benefits

- Eliminates need to quantify inorganic phosphate (Pi, 31P)
- Helps basic science researchers investigate energetic foundation of function and dysfunction of certain organs and tissues
- Improved signal-to-noise ratio (SNR) over other methods

Features

- Measure of energetic function of heart tissue with high spatial resolution
- Magnetic resonance spectroscopy-magnetization saturation transfer (MRS-MST) technique
- Double-saturation 31P MST protocol

Technology ID
20130111

Category
Engineering & Physical Sciences/Instrumentation, Sensors & Controls
Engineering & Physical Sciences/MRI & Spectroscopy
Life Sciences/Diagnostics & Imaging
Life Sciences/MRI & Spectroscopy
Software & IT/Algorithms

Learn more

Applications

- Nuclear Magnetic Resonance (NMR)
- Magnetic Resonance Imaging (MRI)
- Magnetic Resonance Spectroscopy(MRI)
- Basic research
- Clinical applications - grade cardiac tissue function, evaluate therapies

Researchers

Jianyi (Jay) Zhang, MD, PhD

Professor of Medicine and Biomedical Engineering, Department of Medicine

External Link (www.cmrr.umn.edu)

Publications

Detection of Myocardial Bioenergetic Deficits: A 9.4 Tesla Complete Non Invasive 31P MR Spectroscopy Study in Mice with Muscular Dystrophy

PLoS ONE, 2015, 10(8): e0135000

Interested in Licensing?

The University relies on industry partners to further develop and ultimately commercialize this technology. The license is for the sale, manufacture or use of products claimed by the patents. Please contact us to share your business needs and licensing and technical interests in this technology.