

Lecture 2

Metabolic Imaging by Hyperpolarized ^{13}C MRI

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Abstract

Following the injection of ^{13}C -labelled probes that are hyperpolarized via dissolution dynamic nuclear polarization (DNP), real-time ^{13}C MR measurements of their biodistribution and biochemical transformation can be recorded in vivo. It has been shown that specific metabolic bioprobes can be used to differentiate between healthy and pathological tissue in preclinical and clinical studies. This technology also provides a unique and invaluable tool to follow and evaluate disease progression and treatment response.

16 research hospitals across the globe are currently performing hyperpolarized ^{13}C MRI studies on patients and, to date, more than 2000 healthy and patient volunteers have been scanned following the intravenous injection of hyperpolarized ^{13}C -pyruvate. Although relatively complex operations were originally required to perform human studies, several recent developments have simplified the workflow for clinical applications of hyperpolarized ^{13}C MRI. I will present novel methods and hardware that open new opportunities through the circumvention of some of the limitations of the current hyperpolarization technology. Central to these developments is the second-generation clinical hyperpolarizer, together with the development of a new pharmacy kit designed for the production of sterile doses of hyperpolarized ^{13}C -molecules. Recent studies of cerebral function and metabolism based on the use of hyperpolarized ^{13}C MRI will also be presented in this lecture.

