Hyperpolarized 13C MRI: Path to Clinical Translation in Oncology

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This white paper discusses prospects for advancing hyperpolarization technology to better understand cancer metabolism, identify current obstacles to HP (hyperpolarized) 13C magnetic resonance imaging's (MRI's) widespread clinical use, and provide recommendations for overcoming them. Since the publication of the first NIH white paper on hyperpolarized 13C MRI in 2011, preclinical studies involving [1-13C]pyruvate as well as a number of other 13C labeled metabolic substrates have demonstrated this technology's capacity to provide unique metabolic information. A dose-ranging study of HP [1,13 C]pyruvate in patients with prostate cancer established safety and feasibility of this technique. Additional studies are ongoing in prostate, brain, breast, liver, cervical, and ovarian cancer. Technology for generating and delivering hyperpolarized agents has evolved, and new MR data acquisition sequences and improved MRI hardware have been developed. It will be important to continue investigation and development of existing and new probes in animal models. Improved polarization technology, efficient radiofrequency coils, and reliable pulse sequences are all important objectives to enable exploration of the technology in healthy control subjects and patient populations. It will be critical to determine how HP 13C MRI might fill existing needs in current clinical research and practice, and complement existing metabolic imaging modalities. Financial sponsorship and integration of academia, industry, and government efforts will be important factors in translating the technology for clinical research in oncology. This white paper is intended to provide recommendations with this goal in mind.

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