

# Moving MRI Towards a Quantitative Future

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Due to exquisite soft tissue contrast and sensitivity to a wide array of physical and physiological tissue properties, MRI has become a cornerstone technology for tissue characterization in radiology. It is often viewed as the ultimate problem solving technology. However, there remain some weaknesses. Signal intensity alone carries no physical meaning, and qualitative, “weighted” images are utilized for most diagnosis. This leads to difficulties in comparison of images between patients, or for the same patient day to day, or even for simple purposes such as enhancement. As the medical world turns its eyes towards precision medicine, these weaknesses become more and more glaring. Partially as a response, there is an increasing shift in MRI towards quantitative imaging, where tissue properties are mapped rather than simply just providing images weighted by the property. In this talk, I will present some solutions to these issues that we have explored at Case Western Reserve University and University Hospitals of Cleveland, along with the implications of such quantitative approaches to tissue characterization, image analysis, and treatment follow up. I will also explore additional possibilities for simplified acquisition and analysis that could have implications for cost and patient populations currently unable to access the technology.

# Recent Updates of Abdominal MR Imaging

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Abdominal magnetic resonance imaging (MRI) is a well-established modality with multiparametric capabilities. However, to take advantage of its full capacity, it is mandatory to master the technique and optimize imaging protocols, apply advanced imaging concepts and understand the use of different contrast media. Contrast-enhanced MR is the cornerstone of body MR, especially for lesion characterization in many intraabdominal solid organs. Recent advances in rapid imaging techniques including non-Cartesian imaging techniques allow multiple acquisitions of arterial phase imaging, and free breathing dynamic imaging for both morphologic and functional assessment of abdominal disease. The use of emerging biomarkers such as perfusion or DWI can derive new information regarding disease detection, prognostication and evaluation of tumour response. Although extracellular agents are the most extensively used contrast agents, hepatobiliary contrast media can provide an extra-layer of functional diagnostic information adding to the diagnostic value of hepatobiliary MR. New advances in liver MRI including T1-, T2\*- and T1 rho mapping techniques, proton density fat fraction (PDFF) and elastography techniques may enable diagnosis of unseen pathologies by conventional techniques in liver and pancreas. Gd-EOB-DTPA can enable assessment of liver function by using postcontrast hepatobiliary phase or T1 reduction rate (normally above 60%). With recent development of PET/MR hardware and software, PET/MR imaging allows for anatomic-metabolic information of abdominal malignancies. MR fingerprinting may enable single slice acquisition and easy implementation of multiparametric MRI and follow-up of patients. Although functional MR imaging gives quantitative measurements and is increasingly being used in clinical practice, the lack of standardization of the protocol is a remained major issue.