Magnetic resonance imaging: Probing information at a sub-anatomical level- adipose tissue imaging

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ABSTRACT

The notion of fat as an inert insulation tissue or energy depot has considerably been reconsidered and fat is now identified an important metabolic organ. This presentation is a brief overview of the different MRI techniques deployed to highlight clinically important aspects of adipose tissue function**.** Three different use cases will be presented to illustrate the importance of those techniques: Lipomatous tumor classification, identification of metabolically healthy obesity and the "beiging" of white adipose cells to mimic brown fat. Adipose tissue has a slower precessing frequency for a given magnetic field strength due to the different nature and structure of the fat molecules. This is the basis for selectively suppressing or enhancing fat signal for specific medical applications. For locations where fat and water co-exist in the same voxel, specific techniques can decompose signal contribution from each proton family and create water-only, or fat-only images where this is clinically relevant. Furthermore, as opposed to water protons, adipose tissue protons do not resonate at a single frequency but have a spectrum depending on the very local magnetic field that each proton is experiencing. This constitutes the basis for probing the molecular structure of fat depots in the body. MRI is capable of providing quantitative information not only of the quantity of signal from adipose tissue but also on the fat content, after imaging sequence configuration and quantitative post-processing for the extraction of biomarkers.