Redefining MRI:
From Image to Insight

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Abdomen 1

SY21-3

Quantitative Liver Fat Assessment with MRI: From Technique to Clinical Practice

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Metabolic dysfunction-associated steatotic liver disease (MASLD) is now one of the most common causes of chronic liver disease worldwide, making accurate quantification of liver fat increasingly important for diagnosis, risk stratification, and monitoring of treatment. Liver biopsy, the traditional reference standard, is limited by its invasiveness, sampling variability, and interobserver disagreement. As a result, MRI-based proton density fat fraction (PDFF) has become the leading noninvasive biomarker for hepatic steatosis.

This lecture reviews the physical basis of quantitative fat imaging and its translation into clinical practice. MR spectroscopy offers a direct measurement but is limited by spatial coverage and technical complexity. Chemical shift-encoded MRI overcomes these constraints, producing whole-liver PDFF maps in a single breath-hold. Reliable PDFF requires correction of several confounders, including T1 bias, T2* decay, and the spectral complexity of fat, which together distinguish a true quantitative measurement from a simple signal fat fraction.

Standardization efforts have shown that PDFF is reproducible across vendors and field strengths, supporting its use for longitudinal assessment. In practice, PDFF enables objective diagnosis and grading of steatosis and is sensitive enough to track treatment response, increasingly serving as an endpoint in clinical trials. Combined with MR elastography, it allows integrated evaluation of fat and fibrosis in a single examination.

In summary, MRI-PDFF is an accurate, reproducible biomarker that bridges MR physics and improved patient care in the management of MASLD.

Keywords: *Hepatic steatosis, Proton density fat fraction, Chemical shift-encoded MRI, Quantitative imaging biomarker*