Redefining MRI:
From Image to Insight

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# Quantitative MRI: Clinical Applications in Abdominal Imaging

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Magnetic resonance imaging (MRI) has evolved beyond conventional anatomical imaging to offer objective, reproducible measurements of tissue properties. Quantitative MRI extracts numerical biomarkers that enable more precise disease characterization, longitudinal monitoring, and treatment response assessment.

In the liver, quantitative MRI has achieved robust clinical adoption. Proton density fat fraction (PDFF) mapping provides accurate, noninvasive quantification of hepatic steatosis, surpassing visual assessment and serving as a reliable endpoint in therapeutic trials for MASLD/MASH. R2* relaxometry enables quantification of liver iron concentration, offering a practical alternative to biopsy in hereditary hemochromatosis and transfusion-related iron overload. MR elastography (MRE) quantifies hepatic stiffness and outperforms serum markers and conventional MRI for fibrosis staging across a wide spectrum of chronic liver diseases. For hepatic tumors including HCC, quantitative parameters including apparent diffusion coefficient (ADC) and T1 mapping provide information on tumor grade, microvascular invasion, and treatment response.

In addition, pancreatic applications of quantitative MRI include PDFF and T1 mapping to assess pancreatic fat and fibrosis in the context of chronic pancreatitis, diabetes, and obesity-related disease, while diffusion and perfusion-based parameters show promise for pancreatic tumor characterization.

Radiomics and AI-based biomarkers are expanding the scope of quantitative abdominal MRI toward population-level risk stratification and precision oncology. While quantitative assessment of hepatic steatosis, iron overload, and fibrosis is already standard of care, ongoing standardization efforts are needed to bring oncologic and emerging organ-specific biomarkers into routine clinical use.

*Keywords:* *Quantitative magnetic resonance imaging, Elasticity imaging techniques, Hepatic steatosis, Malignancy*