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From Image to Insight

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Abdominal DWI Today: Practical Applications and the Role of IVIM

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Diffusion-weighted imaging (DWI) has become an essential component of abdominal MRI, with its most established and widely used applications in liver imaging. In daily practice, liver DWI provides high lesion-to-background contrast and improves the detection of focal liver lesions, including small hepatocellular carcinoma, liver metastases, and other malignant lesions. DWI is particularly valuable as a complementary sequence to dynamic contrast-enhanced MRI and hepatobiliary phase imaging, helping radiologists increase diagnostic confidence when evaluating lesion conspicuity, tumor burden, and post-treatment changes.

Beyond lesion detection, apparent diffusion coefficient (ADC) measurements offer quantitative information related to tissue cellularity, necrosis, fibrosis, inflammation, and treatment response. In hepatocellular carcinoma and liver metastases, ADC has been investigated for lesion characterization, prediction of tumor aggressiveness, and assessment of response after locoregional or systemic therapy. In diffuse liver disease, DWI-derived parameters may reflect fibrotic or inflammatory changes, although their clinical interpretation remains challenging because ADC is influenced by perfusion, fat, iron deposition, motion, scanner settings, and b-value selection.

Intravoxel incoherent motion (IVIM) imaging provides a more advanced approach by separating diffusion-related and perfusion-related signal components using multiple b values. IVIM-derived parameters, including true diffusion coefficient, pseudo-diffusion coefficient, and perfusion fraction, may provide additional insight into hepatic microstructure and microcirculation. In the liver, IVIM has shown potential for assessing liver fibrosis, characterizing focal liver lesions, and evaluating hepatocellular carcinoma biology, including pathological grade and microvascular invasion. However, IVIM remains an evolving technique, and its routine clinical use is limited by acquisition heterogeneity, fitting instability, motion sensitivity, and insufficient standardization.

Although the liver will be the main focus of this lecture, selected applications in the biliary system and pancreas will also be discussed. In biliary imaging, DWI can serve as an adjunct to conventional MRI and MR cholangiopancreatography for differentiating benign and malignant gallbladder or biliary tract lesions. In pancreatic imaging, DWI contributes to the detection and characterization of pancreatic ductal adenocarcinoma, neuroendocrine tumors, and inflammatory pancreatic disease, and may help assess response after neoadjuvant therapy. IVIM may also have potential in pancreatic lesion characterization, although the evidence is less mature than in liver imaging.

This lecture will provide a practical overview of abdominal DWI today, emphasizing liver imaging while briefly extending to biliary and pancreatic applications. The discussion will focus on how DWI can be incorporated into routine interpretation, how ADC and IVIM parameters should be understood, and what limitations must be recognized before using these techniques as quantitative biomarkers.

Keywords: *Diffusion-weighted imaging, Liver MRI, Apparent diffusion coefficient, Intravoxel incoherent motion, Hepatobiliary and pancreatic imaging*