Redefining MRI:
From Image to Insight

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교육세션 2-1

Kidney and Adrenal MR Imaging

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Magnetic resonance imaging (MRI) is playing an increasingly important role in the evaluation of renal and adrenal diseases, providing multiparametric, radiation-free assessment beyond conventional morphologic imaging.

In renal imaging, MRI serves as a complementary modality to CT for characterization of indeterminate renal masses and offers unique functional assessment of renal parenchyma. Recent developments include the formal incorporation of MRI into the Bosniak Classification Version 2019, which improves specificity, reduces unnecessary surgery for benign cystic lesions, and enhances interobserver agreement. Multiparametric MRI also facilitates characterization of solid renal masses through assessment of enhancement patterns, diffusion restriction, intratumoral fat, and clear cell likelihood scoring, enabling noninvasive subtype prediction and supporting personalized management. Functional techniques such as diffusion-weighted imaging (DWI), blood oxygenation level-dependent (BOLD) imaging, arterial spin labeling (ASL), T1/T2 mapping, and phase-contrast MRI have emerged as promising biomarkers for evaluating renal fibrosis, inflammation, perfusion, and oxygenation in chronic kidney disease and renal transplantation. In autosomal dominant polycystic kidney disease (ADPKD), MRI-derived total kidney volume has become an established imaging biomarker for disease progression and treatment selection.

In adrenal imaging, non-contrast CT remains the first-line modality for adrenal incidentaloma evaluation, while MRI serves a critical problem-solving role when CT findings are indeterminate or when radiation and iodinated contrast administration are undesirable. Chemical shift imaging (CSI) remains the cornerstone of adrenal MRI, enabling detection of intracellular lipid and accurate characterization of adenomas. Recent guidelines emphasize MRI as an adjunctive modality for lesions with indeterminate CT attenuation values. MRI also contributes substantially to the differentiation of adrenal hyperplasia, pheochromocytoma, adrenocortical carcinoma, metastases, and other benign adrenal lesions. Awareness of technical and interpretive pitfalls in CSI acquisition, subtraction imaging, and quantitative measurements is essential to avoid diagnostic errors. Current management strategies increasingly rely on multidisciplinary assessment, with MRI providing valuable characterization of indeterminate lesions while the role of adrenal washout CT continues to diminish.

In summary, advances in multiparametric MRI techniques, quantitative imaging biomarkers, and updated guideline-based applications have expanded the role of MRI in both renal and adrenal imaging. These developments support more accurate lesion characterization, improved risk stratification, noninvasive functional assessment, and increasingly personalized patient management.

Keywords: *Renal mass, Adrenal incidentaloma, Magnetic resonance imaging, Chemical shift imaging*