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From Image to Insight

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Chest

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MRI Assessment for Predicting Malignancy in Thymic Epithelial Tumors

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Thymic epithelial tumors (TETs) represent a heterogeneous group of anterior mediastinal neoplasms ranging from indolent thymomas to highly aggressive thymic carcinomas. Accurate preoperative assessment of tumor malignancy is clinically important because histologic subtype and biologic aggressiveness influence treatment planning, surgical strategy, prognosis, and the need for multimodal therapy. Although computed tomography remains widely used for the initial evaluation of mediastinal masses, magnetic resonance imaging (MRI) provides complementary information through superior soft-tissue contrast and functional imaging techniques.

Morphologic MRI features, including tumor size, contour, internal heterogeneity, capsular integrity, invasion of adjacent structures, cystic or necrotic change, hemorrhage, and pleural dissemination, can provide important clues regarding tumor aggressiveness. However, morphology alone may be insufficient for reliable differentiation between low-risk thymomas, high-risk thymomas, and thymic carcinomas. Therefore, functional MRI techniques have gained increasing attention. Diffusion-weighted imaging (DWI) and apparent diffusion coefficient (ADC) measurements reflect tissue cellularity and extracellular space, and restricted diffusion may be associated with higher tumor cellularity and malignant potential. ADC values may help distinguish more aggressive tumors from less aggressive lesions, although interpretation should consider technical variability and overlap among tumor subtypes.

Perfusion-related MRI parameters may further enhance tumor characterization by assessing vascularity, enhancement kinetics, and microvascular permeability. Dynamic contrast-enhanced MRI can provide quantitative or semi-quantitative information related to tumor perfusion and angiogenesis, which may correlate with pathologic aggressiveness. When combined with conventional morphologic assessment and diffusion parameters, perfusion imaging may improve diagnostic confidence and support a more comprehensive evaluation of thymic epithelial tumors.

This lecture will discuss practical approaches to MRI protocol design, key imaging features to evaluate, and the potential value of multiparametric MRI in preoperative risk stratification. The integration of morphologic, diffusion, and perfusion findings may contribute to more accurate prediction of malignancy, better differentiation of tumor subtypes, and improved communication between radiologists, thoracic surgeons, oncologists, and pathologists.

Keywords: *Thymic epithelial tumors, Multiparametric MRI, Diffusion and perfusion imaging*