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CMR for Pulmonary Hypertension

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Right heart catheterization remains the gold standard for the diagnosis of pulmonary hypertension (PH). However, non-invasive imaging plays an essential role in clinical practice, and its value is increasingly recognized. Cardiovascular magnetic resonance (CMR) provides comprehensive and reproducible assessment of both ventricles without acoustic window limitations, while also enabling evaluation of pulmonary vascular morphology and hemodynamics. Although less accessible than echocardiography, CMR offers unique strengths for diagnosis, risk stratification, and longitudinal follow-up. Importantly, its repeatability without ionizing radiation makes it particularly suitable for serial assessments in PH.

A wide spectrum of CMR techniques can be applied in this context. Cine imaging enables accurate volumetry and ejection fraction analysis, while feature tracking provides strain parameters as sensitive markers of ventricular dysfunction. Phase-contrast MR allows quantification of blood flow velocity, stroke volume, and regurgitant fraction. Four-dimensional (4D) flow CMR extends this to detailed three-dimensional analysis of intracardiac and pulmonary hemodynamics. In addition, dynamic contrast-enhanced MRA and lung perfusion imaging allow direct evaluation of pulmonary circulation. Myocardial tissue characterization using T1/T2 mapping and late gadolinium enhancement contributes non-invasive evaluation of fibrosis and remodeling.

These diverse parameters have demonstrated clinical utility for assessing disease severity, predicting prognosis, and monitoring treatment response. Right ventricular volumes, pulmonary artery stiffness, strain indices, and advanced flow-derived measures are particularly valuable in risk stratification.

In this lecture, an overview of current applications of CMR in pulmonary hypertension, illustrated by recent research findings and representative clinical cases will be provided. The discussion will emphasize its strengths in diagnosis, disease characterization, prognostication, and therapy monitoring.

Keywords: *Pulmonary hypertension, CMR*