In this issue of *Radiology*, Johns and colleagues derive and validate a comprehensive MRI method for the noninvasive estimation of mean pulmonary arterial pressure (mPAP) at right-sided heart catheterization (RHC) (1). This is a retrospective secondary analysis of prospectively collected data from the ASPIRE (Assessing the Spectrum of Pulmonary Hypertension Identified at a Referral Center) database.

The subset selected for analysis included 603 participants with contemporaneous RHC and no evidence for contributing left-sided heart abnormalities based on a normal-sized left atrium of less than 41 mL.

The 603 participants were arbitrarily divided into a “derivation” cohort (n = 300) and a “validation” cohort (n = 303). Investigators then applied statistical modeling to the correlation of 30 MRI variables with right-sided heart pressure measurements while setting a threshold of at least 25 mm Hg for pulmonary hypertension. Three MRI measurements emerged as most significant: intraventricular septal angle, ventricular mass index (right ventricular mass/left ventricular mass), and black blood slow flow score. From these three measurements, two models were created: cardiac MRI mPAP model 1 (right ventricle and black blood) = −179 + log_{10} intraventricular septal angle × 42.7 + log_{10} ventricular mass index × 7.57 + black blood slow flow score × 3.39; and, simplified by excluding the black blood flow score, cardiac MRI mPAP model 2 (right ventricle pulmonary artery) = −231.423 + log_{10} intraventricular septal angle × 53.8 + log_{10} ventricular mass index × 8.708 + diastolic pulmonary artery area × 0.009.

These apparently unwieldy and nonintuitive computer-generated equations with both log_{10} factors correlate strongly with RHC-measured mPAP (in millimeters of mercury) (model 1: R = 0.80, 95% confidence interval [CI] = 0.75, 0.84; model 2: R = 0.80, 95% CI = 0.76, 0.85). Both equations also have small Bland-Altman biases (3.9% and 0.9%, respectively) with reasonable 95% agreements and intraclass coefficients of 0.78 and 0.79.

This should be contrasted with the most commonly used imaging tool for documentation of suspected pulmonary hypertension, examination of the tricuspid valve for regurgitation with color Doppler echocardiography. The tricuspid valve maximum reflux velocity is measured and fit to the modified Bernoulli equation, as follows:

\[ \text{trans-tricuspid reflux pressure (in millimeters of mercury)} = 4 \times \text{velocity}^2. \]

It follows that estimated pulmonary artery pressure (in millimeters of mercury) = trans-tricuspid reflux pressure (in millimeters of mercury) + central venous pressure (in millimeters of mercury), where central venous pressure may be estimated based on ultrasonic inferior vena cava configuration or level of collapsing neck or hand veins versus the level of the right atrium with physical examination.

Thus, the Doppler echocardiography method for estimating pulmonary artery pressure has the advantages of a rapid noninvasive examination with a clear physiologic basis for each of the two components.

These echocardiography-based pulmonary artery pressure estimates are typically readily accomplished and useful. However, owing to limitations in transthoracic acoustic windows, they may be rather difficult to optimally perform in more than half of all patients with pulmonary hyperinflation (2).

Thus, cardiac MRI as performed by Johns et al (1) and perhaps other investigators (3) may displace echocardiography as the noninvasive method of choice for the evaluation of suspected pulmonary hypertension.

There are some important limitations. The three measurements, intraventricular septal angle, ventricular mass index (right ventricular mass/left ventricular mass), and black blood slow flow score, result in time-consuming analysis, with the potential for different results depending on the cardiac MRI environment where they are determined.

Potential solutions to these limitations may be achieved by the future application of deep learning approaches to automate the key cardiac MRI measurements and their analyses so that right-sided heart pressure estimates may accompany all cardiac MRI reports.

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**References**