



Editorial

Traditional screening tool in the era of modern treatment for chronic thromboembolic pulmonary hypertension

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1. Editorial comments

Right ventricular (RV) dysfunction is one of the leading causes of death in patients with pulmonary hypertension (PH) [1]. In the early stage of PH, RV pressure overload induces adaptive cardiac hypertrophy to maintain its performance. As the disease progresses, RV dilation occurs with fibrotic changes, losing both systolic and diastolic functions and resulting in RV failure and death. Several clinical studies have reported that RV dysfunction is a strong determinant of poor prognosis in both chronic thromboembolic pulmonary hypertension (CTEPH) and pulmonary arterial hypertension (PAH) [1–3].

Cardiac magnetic resonance (CMR) provides reliable data on RV structural and functional parameters such as mass index, wall motion, wall thickness, volume, and ejection fraction (EF) [3]. It has been reported that stroke volume index, RVEF, and indexed RV end-diastolic (RVEDVI) and end-systolic volume (RVESVI) can predict poor prognosis in patients with PAH [1]. Conversely, RV mass index does not appear to correlate as strongly with mortality in severe PAH, probably because concentric RV hypertrophy develops from relatively earlier stage of PH to compensate the increased afterload.

Recently, balloon pulmonary angioplasty (BPA) has shown promising results for the treatment of inoperable CTEPH [4,5]. BPA could improve symptoms, hemodynamics and exercise capacity and prognosis of patients with CTEPH. However, it has not been well investigated whether RV dysfunction normalizes during the long-term follow-up

after BPA. The study reported by Asano et al. addressed several important issues [6]. First, residual RV dysfunction, defined as RVEDVI of >100 ml/m² or RVEF of <45% on CMR imaging was identified in 27 of 61 patients despite significantly improved hemodynamic parameters at approximately 1 year after the final BPA. Second, multivariable analysis revealed prolonged QRS duration (cutoff value of 102 ms) at baseline to be an independent predictor for residual RV dysfunction after BPA. Additionally, QRS duration was negatively correlated with follow-up RVEDVI and RVEF. Importantly, baseline electrocardiogram (ECG) parameters reflecting RV hypertrophy could not predict the occurrence of residual RV dysfunction after BPA although the R/S ratio in V₁ was the most sensitive predictor of therapeutic response to pulmonary vasodilators in PAH [7].

Histopathological analysis in the present study revealed that QRS duration was positively correlated with areas of RV fibrosis that may delay conduction system in the RV [8]. The interventricular dyssynchrony caused by this delayed conduction may cause leftward ventricular septal bowing and decrease LV filling and stroke volume in patients with PAH. Although detailed mechanisms of prolonged QRS duration are not completely understood, Sun et al. reported that prolonged QRS duration in idiopathic PAH was positively correlated with RV diameter and independently associated with poor prognosis [9]. Furthermore, Gatzoulis et al. found that QRS prolongation was significantly associated with RV size in 178 patients after repairing the tetralogy of Fallot [10]. Remarkably, QRS width was not particularly prolonged in cases of significant residual RV outflow tract obstruction alone, suggesting that QRS prolongation reflects RV dilation rather than an increase in RV mass due to hypertrophy. Therefore, it is reasonable that QRS duration rather than the ECG parameters for RV hypertrophy is related to maladaptive RV dysfunction in patients with CTEPH.

The findings of the present study may have significant clinical implications. CMR imaging can evaluate regional and global RV performance without complex geometric limitations. However, it is difficult for some hospitals to routinely perform CMR imaging because the procedure requires considerable technical support and expertise. Screening for prolonged QRS duration using noninvasive, inexpensive ECG should be part of the routine assessment of patients with CTEPH in predicting recovery of RV function after BPA.

Disclosures

None.

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