Assessment of pulmonary regurgitation by cardiac magnetic resonance: is the reverse volume more accurate than the regurgitation fraction?

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Introduction. Pulmonary regurgitation (PR) is a common finding after right ventricular (RV) outflow tract surgery and may result in RV dilation and dysfunction. Cardiac magnetic resonance (CMR) imaging is the imaging modality of choice for the quantification of PR and assessment of RV size and function. The expression of the regurgitant burden as a fraction of forward pulmonary flow is commonplace. However, PR fraction (PRF) may be highly variable in terms of absolute PR volumes (PRV).
Therefore, we hypothesized that a volumetric expression of PR would be a better measure of ventricular preload and a more accurate reflection of degree of insufficiency.

Methods. We retrospectively studied 44 patients (mean age 23±11 years, 27 males) with pulmonary valve or right ventricle-to-pulmonary conduit regurgitation due to various congenital heart disease: 21 patients with tetralogy of Fallot, 8 after Ross operation, 6 with pulmonary atresia or critical pulmonary stenosis, 3 with transposition of the great arteries, 3 with double outlet right ventricle, and 1 with truncus arteriosus. CMR were performed before and after surgical valve replacement (14 patients) or percutaneous Melody valve implantation (30 patients). Short axis ECG-triggered cine and phase contrast sequences were acquired to calculate RV volumes and pulmonary flow. The volumes were adjusted for BSA. We calculated both PRF (retrograde to antegrade flow ratio) and PRV (ml/m²) and correlated the results with RV end diastolic volume index (RVEDVi) before and after procedures, and RV stroke volume index (SVi). A Spearman test was used and p-value ≤0.05 was considered significant.

Results. Overall PRF (%), PRV (ml/m²), RVEDVi (ml/m²) and SVi (ml) were 23±25, 0.29±0.22, 99±43 and 45±16 respectively. Measures of RVEDVi were more closely correlated with indexed PRV (r=0.549; p<0.001) when compared with PRF (r=0.480; p=0.001). Similarly, RVSVi was more significantly correlated with PRV (r=0.701; p<0.001) than PRF (r=0.605; p<0.001). The difference of RVEDVi before and after the procedure significantly correlated both with PRF (r=0.427; p=0.004) and PRV (r=0.489; p=0.001).

Conclusions. PR expressed as an absolute volume is better able to predict RV dilation and RV stroke volume than PR expressed as fraction.