

Intraindividual Validation of Ventricular Volume Measurement by Aortic and Pulmonary Arterial Flow Measurements in Routine Clinical Cardiovascular Magnetic Resonance of Congenital Heart Disease

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Introduction: Phase-contrast magnetic resonance imaging is an accurate quantitative tool for blood flow measurement in cardiovascular magnetic resonance (CMR). The aim of this study was to validate right and left ventricular stroke volume (RVSV & LVSV) measurement by forward flow stroke volume from aortic and pulmonary arterial measurements during CMR in routine clinical cases of congenital heart disease (CHD).

Methods: SV determined by ventricular volume assessment and arterial forward flow measurements during CMR of 147 consecutive routine patients (median age 22 years, range 0.5 – 64 years) with CHD, were retrospectively obtained from their clinical reports. Patients with ventricular septal defects, mitral valve regurgitation or severe tricuspid-valve-regurgitation were excluded. 126 LVSV were compared to the ascending aorta forward flow stroke volume (AoSV). 99 RVSV were compared to the main pulmonary forward flow stroke volume (MPASV). Ventricular SV was determined using a routine standard stack of cine axial slices. Arterial forward flow SV was determined using a routine standard phase-velocity quantitative flow sequence.

Results: AoSV correlated with LVSV by ($r^2=0.9$, $p<0.0001$) and showed upper and lower limits of agreement in Bland Altman analysis of 11ml and -12 ml, mean difference -1ml. Similarly RVSV correlated with the accompanying MPASV ($r^2=0.8$, $p<0.0001$) and showed upper and lower limits of agreement in Bland Altman analysis of 18ml and -26ml, and mean difference -4ml.

Conclusion: Measured ventricular SV correlates closely with SV, assessed by CMR flow measurement in the originating great artery in routine clinical CMR of CHD. Validation of volume measurements in routine clinical CMR of CHD is very important, as this method can be used confidently in even complex and often distorted ventricular geometry in CHD.