Real-Time 3D-Echocardiography of the Pediatric Right Ventricle - influence of different quantification software


Department of Pediatric Cardiology, University of Bonn, Bonn, Germany (1); Department of Congenital Heart Diseases, Herz- und Diabetesszentrum NRW, Bad Oeynhausen, Germany (2); Department of Pediatric Cardiology, Ludwig Maximilian Universität, München, Germany (3)

Background: Determining right ventricular (RV) volume and function is essential for therapy and follow-up in patients with heart disease. Real-time 3D echocardiography (RT3DE) is a promising method for RV assessment, however there is no systematic study comparing the inherent influence of different evaluation software on the resulting measurements.

Methods: 379 healthy children and adolescents (range, 1 day-216 months) underwent RT3DE imaging of the RV, 6 subsequently underwent CMR imaging. RT3DE data sets were quantified using both a knowledge-based reconstruction software (VMS, Ventripoint Diagnostics Ltd., Bellevue, Washington, US) and a semiautomatic border detection software (TomTec RV V1.1, Unterschleissheim, Germany). CMR data sets were quantified by the method of discs (MOD).

Results: Bland-Altman Analysis showed estimations of end-diastolic volume (EDV, Figure) using VMS to be larger than using TomTec, while estimations of end-systolic volume (ESV) were slightly smaller, resulting in larger stroke volume (SV) and ejection fraction (EF) in VMS (Table). Compared with CMR there were trivial volume overestimations using VMS (EDV: Bias: 1.73ml = 1.69%, SD: 1.82ml = 1.69%), (ESV: Bias: 1.12ml = 2.54%, SD: 2.53ml = 4.85%), (SV: Bias: 0.62ml = 0.92%, SD: 2.96ml = 3.59%) and underestimation of EF (Bias: -0.40%, SD: 1.84%) while volumes and EF were underestimated using TomTec (EDV: Bias: -9.0ml = -8.98%, SD: 13.41ml = 13.73%), (ESV: Bias: -1.03ml = -1.44%, SD: 3.55ml = 6.88%), (SV: Bias: -7.99ml = -14.72%, SD: 11.87ml = 21.48%), (EF: Bias: -3.45%, SD: 5.07%). Intra- and interobserver-variation for EDV, ESV and SV were excellent both in VMS and TomTec with intraclass correlation coefficients (ICC) between 0.992-0.998. Regarding EF, ICC for intraobserver variability was significantly lower using TomTec (ICC 0.792; CI [0.829-0.843]) if compared to VMS (ICC 0.973, CI [0.941-0.987]).

Conclusions: 3D-volumetric assessment of the RV is possible using different evaluation software. However, resulting measurements differ depending on the software used. Therefore a different set of reference values is required.