Analysis of the right ventricle by 4D-RV-Function 2 in healthy children and young adults – first results


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Introduction: Echocardiographic quantification of right ventricular (RV) function is limited if only a standard two dimensional approach is used. Realtime 3D-Echocardiography (RT3DE) is a promising method to get more valid data especially for enddiastolic (EDV), endsystolic (ESV), stroke (SV) volumes and ejection fraction (EF). Simultaneous assessment of deformation parameters as longitudinal Strain (LS) within the same dataset would be of additional value.

Methods: 20 healthy children and adults (6-40, median 16.4 ys, 13 female) were consecutively investigated by cardiac magnetic resonance imaging (CMR, 3T Achieva, Philips, Cine SSFP, frame rate 20-24/s ) and RT3DE (Vivid 7, IE33, 4-beat acquisition, frame rate 20-30/s). CMR data were analysed using the summation of disks method, RT3DE data were processed using a prototype of the 4D RV-Function 2 software (Tomtec, Germany) by two separate expert investigators blinded to each other. For interobserver variability a third investigator was introduced. Statistical analysis by Bland Altman defining differences in % and including limits of agreement (LOA), correlations by Pearson-Bravais.

Results: Feasibility of 90% (18 RT3DE datasets). Enddiastolic volumes (EDV) calculated by CMR ranged from 60-197 ml. RT3DE provided mild mean underestimation of EDV (4.5±8.5%, LOA -12.5% to 21.5%, r=0.990), ESV (1.4±15.4%, LOA -29.5% to 32.3%, r=0.951), SV (6.5±12.4%, LOA -18.3% to 31.3%, r=0.974) and EF (2.0±8.9%, LOA -15.8% to 19.8%, r=0.969). Intraobserver-variability for EDV (-1.7±8.2%, LOA -18% to 14.6%, r=0.979) and ESV(2.9±13.2%, LOA -23.5% to 29.3%, r=0.928) was low. Interobserver-variability for EDV (0.8±15%, LOA -29.1% to 30.8%, r=0.928) was better than for ESV (2.0±24%, LOA -46% to 50%, r=0.887). Mean septal LS was -21±5.9%, free wall LS revealed higher values of -29±6.5%(p<0.001). Mean calculation time for RT3DE was 5 minutes per dataset.

Conclusions: RV-Function 2 provides good feasibility and promising accuracy within a wide range of volumes of healthy individuals. Reproducibility of ESV estimation was acceptable but less good than of EDV. Deformational parameters can also be assessed within a short period of calculation time from the same RT3DE dataset. Further validations have to be carried out in order to undermine that the method is an interesting tool for clinical use in patients.