MP2-1

Knowledge-based 3D reconstruction compared to MRI for evaluation of right ventricular volumes and function in congenital heart diseases affecting the right ventricle

Khraiche D. (1), Ladouceur M.(1), Bonnet D.(1), Guillard O.(1), Raimondi F.(1)
Hôpital Universitaire Necker Enfants Malades, Paris France(1);

Background:
Right ventricular (RV) volume and ejection fraction (RVEF) measurements are essential in the management of children with congenital heart disease. Cardiac Magnetic resonance imaging (MRI) is considered the reference method for RV volumes and RVEF measurements. Three-dimensional knowledge-based reconstruction (3D-KR) derived from two-dimensional echocardiographic imaging is a novel technique. It has proved to provide accurate and reproducible measurements of RV volumes in patients with Tetralogy of Fallot or pulmonary arterial hypertension. The aim of this study was to assess the feasibility and reliability of this novel echocardiographic technique in children (age 3 months to 18 years) with diverse CHD involving the right ventricle.

Methods:
75 children (mean age 9.2 +/- 2.3 years) referred for cardiac MRI, were included. Among them, 25 patients had barometric overload, 32 patients had volumetric overload, and 18 patients had mixed overload. Echocardiographic image acquisition was performed using a standard ultrasound scanner linked to a Ventripoint Medical Systems unit. Parameters analyzed were end-diastolic volume (EDV), end-systolic volume (ESV), and RVEF. The method of disks was used for CMR RV volumes. Intra-observer, inter-observer, and inter-technique variability was assessed using Pearson's correlation coefficient (CC), coefficients of variation (COV), and Bland-Altman analysis.

Results:
Feasibility of 3D-KR was 100%. Echocardiographic RV volumes correlated well with CMR (EDV, CC = 0.96; ESV, ICC = 0.93; RVEF, ICC = 0.75). For inter-observer analyses, COV were 8% for EDV, 15% for ESV, and 17% for EF. For intra-observer analyses, COV were 4% for EDV, 7% for ESV, and 9% for EF. The correlation of volumes and RVEF with MRI was slightly worse in the group with mixed overload compared with patients with volumetric or barometric overload. 3D-RVEF was overestimated compared with MRI whereas the volumes tend to be underestimated.

Conclusions:
3D-KR is feasible in children. It provides accurate and reproducible measurements of RV volumes. RVEF is less accurate and reproducible than volumes when compared with MRI but values are still comparable with both techniques. This new technique can be used as an accurate routine tool to assess RV function in CHD with pure barometric or volumetric overload.