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Usefulness of three-dimensional echocardiography for the assessment of right ventricular volume and function in children; comparison with cardiac magnetic resonance

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The accurate assessment of right ventricular function in children is still a diagnostic challenge for which cardiac magnetic resonance (CMR) is considered the gold standard.

The aim of the study was to assess right ventricular volume and function in children using 3D-echocardiography (3D-ECHO) and compare the results to those obtained with cardiac magnetic resonance.

Methods. The study group consisted of 43 children aged 4 months - 17 years, average 13.7± 3.8 years, in whom CMR was performed. 27 patients had ventricular arrhythmia (in 13 normal cardiac anatomy and function was found, in 10 – mild functional abnormality, in 4 – right ventricular arrhythmic cardiomyopathy); 7 patients were diagnosed with left ventricular cardiomyopathies, 9 patients were suspected of myocarditis, but proved to be healthy.

In all children 3D echocardiography (offline analysis) was used to assess right ventricular endsystolic volume (ESV), enddiastolic volume (EDV) and ejection fraction (RVEF) – the results were compared to CMR using the regression analysis.

Results. The values of right ventricular EF (RVEF) measured in 3D-ECHO were 22.91-70.35%, mean 54.03±8.82%; in CMR – 25.00-70.00%, mean 53.62±9.36%. The relation between values of RVEF obtained by 3D-ECHO and CMR is linear and it can be approximated by the identity function (estimated slope = 0.993–1, p<0.00001, R-squared=0.998). However enddiastolic and endsystolic volumes measured in 3D-ECHO were significantly lower comparing to CMR – for mean EDV respectively 104 ml vs 153 ml (p-value<0.00001), for ESV 48 ml vs 73 ml (p-value<0.00001). Modification of 3D-ECHO results using the coefficient of 1.38 and 1.44 for EDV and ESV, respectively – significantly improved the consistency of the results with those obtained with CMR.

Conclusions: 3D-echocardiography is a valuable tool for assessment of right ventricular ejection fraction that strongly correlates with cardiac magnetic resonance. The use of coefficient estimated by the study improves the consistency of right ventricular enddiastolic and endsystolic volume measured by 3D-echoradiography with results obtained by cardiac magnetic resonance.