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Surrogate echocardiographic parameters to assess right ventricular function in children with congenital heart disease or pulmonary hypertension.

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Background: In congenital heart diseases (CHD) and pulmonary hypertension (PH), right ventricle (RV) dysfunction is associated with prognosis. Because of RV pyramidal shape, RV ejection fraction measured by standard 2D echocardiography is not accurate. Surrogate parameters of RV systolic function are used in routine. However, their dependence to RV loading conditions has not been tested. Moreover, studies have suggested that these parameters are altered by cardiac surgery.

The aim of our study was to assess the feasibility, reproducibility and relevance of surrogate echocardiographic parameters of RV systolic function in children with CHD involving the RV or pulmonary hypertension (PH).

Methods: We recruited 294 consecutive children with RV pathological loading conditions: 159 have barometric overload, 102 have volumetric overload, 33 have mixed overload. Among them 154 patients have history of cardiac surgery. The median age was 9.25+/- 2.32.

We assessed RV global systolic function by measuring the Fractional area change (FAC). 31 patients had also assessment of RVEF by MRI and 168 had assessment of RVEF by the Ventripoint system (VMS).

We analyzed the feasibility, reproducibility and relevance of parameters of RV longitudinal systolic function: the Tricuspid Annular Peak Systole Excursion (TAPSE), RV 2 dimensional longitudinal strain and Tissue Doppler derived parameters: tricuspid systolic excursion velocity (Sa), myocardial acceleration during isovolumic contraction (IVA), and RV Tei index.

Results: TAPSE and Sa are the surrogate parameters with the best feasibility (>98%) and reproducibility (inter and intra observer variability<6%). 2D strain, IVA and Tei index have worse feasibility (78, 83 and 91% respectively) and reproducibility (inter observer variability of 10, 21 and 19%). TAPSE and Sa were correlated to RV loading conditions. In patients with history of cardiac surgery, no parameter of longitudinal function was correlated to FAC or RVEF. Only in PH, TAPSE and Sa were correlated to RV global systolic function assessed by FAC (respectively $r = 0.84$ and $r = 0.54$, $p < 0.001$).

Conclusion: Parameters of longitudinal RV systolic function correlate with loading conditions. They cannot be used to predict RVEF in children with CHD or in children who had undergone cardiac surgery. They can only be used to predict RVEF in PH.