

Approaching routine evaluation of right ventricular performance with advanced echocardiographic techniques in patients with hypoplastic left heart syndrome: a study of feasibility and reproducibility

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Introduction: Preserving right ventricle (RV) function is essential for the prognosis of children with hypoplastic left heart syndrome (HLHS). The aim of this study was to assess the feasibility of advanced echocardiographic techniques for routine evaluation of RV sizes and function, speculating the possible impact of the type of Norwood operation.

Methods: 19 children with HLHS treated with Norwood operation (7 with mBT shunt and 12 with RV-PA conduit; age 0,2-9,9 years) were prospectively recruited in this study. Ventricular volumes and ejection fraction (EF) were obtained by three-dimensional echocardiography (3DE), with both semiautomatic border detection and discs summation methods. Global and regional, longitudinal and circumferential Strain and Strain Rate were determined using speckle tracking echocardiography (STE). Images were analyzed offline (Philips Q-lab 10.5). Intra and inter-observer reliabilities were estimated using Intraclass Correlation Coefficient (ICC).

Results: Semiautomatic border detection method and discs summation method correlated strongly in defining ventricular volumes and EF. Ventricular volumes didn't differ between the two study groups; mean EF was $52,7 \pm 9,9\%$ in mBT shunt group and $45,8 \pm 10,5\%$ in RV-PA conduit group ($p=0,196$), using semiautomatic border detection method, and $50,4 \pm 6,7\%$ and $44,6 \pm 8,4\%$ ($p=0,161$) respectively, with discs summation method. Mean global longitudinal strain was $-22,1 \pm 4,2\%$ in mBT shunt group and $-19,1 \pm 4,5\%$ in RV-PA conduit group ($p=0,200$), mean global circumferential strain was $-13,1 \pm 3,9\%$ and $-10,3 \pm 3,0\%$ respectively ($p=0,138$). There were no statistical differences in global and regional myocardial deformation indices between the two study groups, except for circumferential Strain Rate in the inferior-lateral segment. ICCs were excellent for almost all 3DE and STE parameters.

Conclusions: 3DE and STE are highly feasible and reproducible for routine evaluation of right ventricular function in children with HLHS. To our knowledge, this is the first study that adopts both three-dimensional echocardiographic methods in this population, proving that they are interchangeable in measuring right ventricular sizes and EF. Further echocardiographic follow up is needed to clearly demonstrate if one variant of the Norwood operation is superior to the other one in our population.