Can the subsystemic right ventricle remodel and contract like a left ventricle after atrial switch repair for transposition of the great arteries? A magnetic resonance feature tracking study

Burkhardt B.E.U. (1,2), Kellenberger C.J. (2,3), Weber R. (1,2), Oxenius A. (1,2), Geiger J. (2,3), Franzoso F. (1,2), Valsangiaco Buechel E.R. (1,2)

Children's Heart Center, University Children's Hospital Zurich, Switzerland (1); Children's Research Center, University Children's Hospital Zurich, Switzerland (2); Diagnostic Imaging, University Children's Hospital Zurich, Switzerland (3)

Introduction: D-transposition of the great arteries can be repaired with re-direction of blood flow either by atrial (Senning) or by arterial (ASO) switch operation. The Senning procedure results in a sub-systemic morphologically right ventricle (RV) and a sub-pulmonary morphologically left ventricle (LV), while ASO creates concordant atrio-ventricular and ventriculo-arterial connections. We sought to determine to what extent the RV after Senning can compensate as a sub-systemic pumping chamber.

Methods: Twenty-three patients (14 Senning, 9 ASO) without significant residual lesions underwent cardiac magnetic resonance imaging. Mean age was 27.6± 5.5y for the Senning and 17.6± 7.1y for the ASO patients (p=0.002). 2D SSFP cine images were post-processed with a feature tracking software (TomTec 2D CPA). Global strain was measured separately for each ventricle in radial and circumferential directions in short axis mid-ventricular slices, and in longitudinal direction in a four-chamber view.

Results: The sub-systemic RV in Senning patients showed reduced strains compared to sub-systemic LV in ASO patients in both radial (21.7% vs. 32.8%; p=0.001) and circumferential (-16.1% vs. -25.5%; p<0.001) directions. In contrast, longitudinal strain values were similar for either ventricular morphology. In sub-pulmonary position, RV presented with lower circumferential strains than LV (-16.7% vs. -19%; p<0.05). No significant difference was observed for global contractile function between morphologically RV and LV in sub-systemic position (EF% 52±9 vs. 58±7), nor in sub-pulmonary position (EF% 60±8 vs. 54±8).

Conclusions: In spite of preserved global contractile function, the sub-systemic RV can adapt and behave like a LV only in longitudinal direction, but not in radial and circumferential shortening. This may reflect the well described specific fibre arrangement of each ventricle. Correspondingly, higher circumferential deformation was found in the morphological LV than RV in sub-pulmonary position.