Correlation Between Right Ventricular Outflow Sizing and Right Ventricular Function and Volumes in Patients With Repaired Tetralogy of Fallot Undergoing Routine MR Follow-up: is There a Better Candidate for Percutaneous Pulmonary Valve Implantation?

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Introduction: cMR is the established tool for routine RV assessment in repaired tetralogy of Fallot (rTOF) patients. Anatomical data of the RVOT are assessed to improve indications for Pulmonary Valve Replacement (PVR), either surgical or percutaneous. Current eligibility criterion for percutaneous treatment (PPVI) is a maximum PT diameter up to 27mm. The aim of this cross-sectional analysis is to improve the ability of CMR to identify patients suitable for percutaneous pulmonary valve implantation (PPVI).

Methods: Patients with rTOF and significant pulmonary regurgitation (PR) underwent routine CMR. In a sub-group of 31 patients a targeted 3D SSFP navigator sequence set at end-systole was also performed to better assess the pulmonary trunk (PT) morphology, length and dimensions. Transverse Diameter (TD) and Superior-Inferior Diameter (SID) and area obtained from the 3D dataset according to vessel analysis principles at three levels (PV remnant, mid-portion, bifurcation) were measured. We assumed that after PPVI the geometry of the PT will shift from elliptic to circular, thus we calculated a predicted PT (pPT= SQRT(4 x elliptic area /PI) circular diameter through geometrical correction of the measured elliptic area at the PV remnant level.

Results: A statistical significant positive correlation was observed between EDV, the area and TD of pulmonary remnant (p < 0.01), although no correlation was observed between EDV and DSI, or between SID, TD, the area and RV ESV and RVEF. The pPT diameter showed a stronger correlation to EDV (both absolute and indexed) as compared to individual observed PT diameters (R2= 0.74). When comparing the current anatomical criteria for PPVI eligibility to the pPT diameter the number of eligible patient increased from 3 to 11 (p<0.05). In addition, in ROC analysis an EDVi between 134 and 139mL/m2 best identified patients eligible for PPVI according to the pPT diameter (AUC=0.44).

Conclusion: Our study suggests that geometrically predicted PT diameters is more strongly associated with RV EDV as compared to measures currently used in clinical practice. Use of predicted PT diameter improves the identification of PPVI eligible patient. Our study suggests that higher rates of PPVI eligible patients are present when EDVi is between 134 and 139mL/m2.