A Novel Echocardiographic Quantification of Pulmonary Valve Regurgitation in Patients with Tetralogy of Fallot

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Introduction: The pulmonary regurgitation (PR) is the most important cause of the right ventricular failure and dilatation in patients long after the definitive surgery for tetralogy of Fallot (TOF), however its quantification of PR is difficult and not standardized by echocardiography but could be measured by cardiac magnetic resonance (CMR). We aim to quantify PR in TOF using a novel echocardiographic imaging modality, Vector-Flow Mapping (VFM) and to validate by CMR using phase-contrast analysis.

Subjects and Methods: fourteen patients with repaired TOF, mean age 17y (2.8-31y), and mean interval from the definitive surgery 15y (1.7—26y). The color Doppler images of right ventricular outflow view including pulmonary artery (RVOT) was obtained by Prosound F75 (Hitachi-ALOKA ltd) with VFM mode, and calculated the both-directional flow across the pulmonary valve as a sum of by integration of multiple sampling gate set on the line along the cardiac cycle by off line analysing program. The ratio of regurgitation to antegrade flow of VFM (PRF-VFM) was compared to those of CMRI using phase-contrast flow quantification (PRF-CMR). PRF-VFM was also evaluated by the previous reported indices such as the presence of diastolic reverse flow in peripheral PA branches, PR pressure half time < 100ms, and PR index <0.77.

Results: PRF-VFM (40.9+/- 9.8%) was well correlated with PRF-CMR (40.7+/- 10.2%) (r=0.68, p<0.01) with good agreement between the two measurements. PRF-VFM>40% had good sensitivity (85.7%) and specificity (85.7%), if PRF-CMR > 40% was considered as a severe PR, however other parameters showed higher sensitivity (71-100%) but poor specificity.(14.3-33%).

To assess the severity of PR, the quantification of PR is mandatory with good sensitivity and specificity. Our new imaging modality of PRF-VFM demonstrates a good agreement with the results of PRF-CMR than any other parameters previously reported. The limitation of this technique is the quality of images of RVOT and color Doppler signal and the turbulent flow by the stenosis > 3m/s.

Conclusions: PRF-VFM is feasible and handy diagnostic imaging with quantification for assessing the severity of PR in patients with TOF, which is clinical valuable.