

EFFECT OF MAIN PULMONARY ARTERY DILATION AND STIFFNESS ON RIGHT VENTRICULAR VOLUME OVERLOAD AND FUNCTION IN PATIENTS WITH REPAIRED TETRALOGY OF FALLOT

Liang Zhong¹, Adeline Phang¹, Xiaodan Zhao¹, Jule Tan¹, and Rusan Tan¹
¹National Heart Centre Singapore, Singapore, Singapore, Singapore

Introduction: Pulmonary regurgitation (PR) and right ventricular (RV) volume overload are common in patients after initial repair of tetralogy of Fallot (TOF) and are associated with adverse long-term outcomes. However, the relationships of pulmonary artery area and stiffness with RV volume overload and function are unknown.

Purposes: To determine the effect of main pulmonary artery area and stiffness on the RV volume and function in patients with repaired TOF.

Methods: 48 patients with repaired TOF (mean age 35 years, male/female: 21/27) and age- and gender- matched 18 normal healthy volunteers were prospectively enrolled for cardiac magnetic resonance in a standard protocol. All studies were performed in 1.5T scanners and used single-slice multiphase acquisition steady-state free precession and velocity-encoded cine. Main pulmonary areas were measured at end-diastole and end-systole phases (see Figure 1). The pulmonary artery stiffness was calculated as relative area change from diastole to systole. The other following parameters were calculated using our in-house software: RV end-diastolic volume, end-systolic volume, ejection fraction, and pulmonary regurgitation. RV end-diastolic volume index ≥ 170 ml/m² was defined as severe RV dilation.

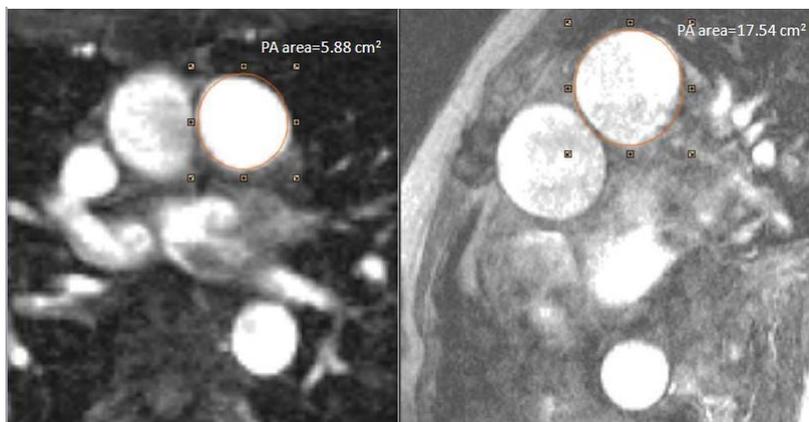


Figure 1. Demonstration of a phase contrast cardiac magnetic resonance image with MPA area measurement in healthy volunteer (left, max PA area = 5.88 cm²) and repaired TOF (right, max PA area = 17.54 cm²).

Results and discussion: MPA area was significant bigger in repaired TOF than in controls (max PA area: 10.72±3.72 cm² vs. 7.55±1.54 cm²; min PA area: 8.25±2.96 cm² vs. 5.56±1.34 cm²) (both P<0.0001). There was a significant relationship between PA area and RV volumes and ejection fraction (see Table 1). The pulmonary artery stiffness index (relative area change) inversely correlated with RV volumes (r=-0.26 for RVEDV, and r=-0.28 for RVESV, both P<0.05). On multivariate analysis, max PA area was found to be the independent predictor of severe RV dilation. ROC analysis revealed that a cut of max PA area of 8.96 cm² yielded the best balanced sensitivity (0.84) and specificity (0.62) for detection of severe dilated RV volume (≥ 170 ml/m²) (AUC = 0.82, p<0.001).

Conclusion: In patients with repaired TOF, PA dilation and stiffness were associated with RV volume overload and impaired RV function. Dilated and stiff PA might effectively accelerate the referral for pulmonary valve replacement.

Table 1 Correlations between PA areas and RV volumes and ejection fraction

	Max PA area (cm ²)	P value	Min PA area (cm ²)	P value
RV End diastolic volume (ml)	0.68	<0.0001	0.73	<0.0001
RV End systolic volume (ml)	0.60	<0.0001	0.68	<0.0001
RV Ejection fraction (%)	-0.28	0.025	-0.35	0.004

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