

## Range of Biventricular Dimensions and Function Evaluated by Steady State Free Precession Cine Magnetic Resonance in Patients With Repaired Tetralogy of Fallot

M. M. Samyn<sup>1</sup>, A. J. Powell<sup>1</sup>, R. Garg<sup>1</sup>, L. Sena<sup>2</sup>, T. Geva<sup>1,2</sup>

<sup>1</sup>Cardiology, Children's Hospital Boston, Boston, Massachusetts, United States, <sup>2</sup>Radiology, Children's Hospital Boston, Boston, Massachusetts, United States

**INTRODUCTION:** Cardiac magnetic resonance (CMR) has become the principal imaging modality late after tetralogy of Fallot (TOF) repair. These patients require serial assessment of residual hemodynamic abnormalities such as pulmonary regurgitation, right ventricular dimensions and function, right ventricular outflow tract (RVOT) obstruction, and others. The goal of this study was to characterize the range of biventricular dimensions and function by steady state free precession (SSFP) cine MR in a large cohort of patients with repaired TOF and to compare between repair with a RVOT patch and RV-to-pulmonary artery conduit.

**METHODS:** All patients, referred to the CMR Program at Children's Hospital Boston from April 1, 2002 through May 12, 2005 for an evaluation of repaired TOF underwent a standardized protocol using a 1.5T scanner. Left and right ventricular end-diastolic (maximal) and end-systolic (minimal) volumes, mass, stroke volumes, and ejection fraction (EF) were determined from short-axis SSFP cine MR and pulmonary regurgitation fraction was measured by phase velocity cine MR across the main pulmonary artery.

**RESULTS:** The cohort of 300 repaired TOF subjects comprised of 206 patients repaired with RVOT patch and 94 patients with RV-to-PA conduit. Demographics are shown in Table I and CMR data in Table 2.

**Table 1** Patient Characteristic

	All Patients (n= 300)	RVOT Patch (n= 206)	RV-PA Conduit (n= 94)	P Value*
Gender (male/female)	1.16	1.37	0.81	0.046
Age at MRI (years)	23.7±14.5 (0.2-67.2)	25.3±14.9 (2.1-65.7)	20.3±13 (0.2-67.2)	0.005
Age at TOF repair (years)	4.99±8.1 (0-51.5)	4.96±8.3 (0-51.5)	5.05±7.5 (0-45.4)	0.935
Time interval from TOF repair to MRI (years)	19.1±9.6 (0.5-46.8)	20.8±9.4 (1.9-46.8)	15.2±8.7 (0.5-35.7)	<0.0001
BSA (m <sup>2</sup> )	1.56±0.42 (0.17-2.37)	1.6±0.4 (0.5-2.3)	1.4±±0.5 (0.2-2.4)	<0.0001

\* Comparison between RVOT patch and RV-PA conduit groups. Data expresses as mean ± standard deviation (range).

**Table 2** MRI Variables (**Abbreviations:** EDV= end-diastolic volume; ESV= end-systolic volume)

	All Patients (n= 300)	RVOT Patch (n= 206)	RV-PA Conduit (n= 94)	P Value*
<b>RV Variables</b>				
EDV index (ml/m <sup>2</sup> )	147.3±53.2 (42.3-386.2)	153.6±53.3 (65.9-382.6)	133.3±50.6 (42.3-386.2)	0.002
ESV index (ml/m <sup>2</sup> )	77.9±41.3 (17.24-328.8)	79.6±38.8 (25.6-287.8)	74.3±46.4 (17.2-328.8)	0.31
Stroke volume index (ml/m <sup>2</sup> )	69.3±20.8 (22.9-149.5)	74±21 (30-149.4)	59±16.4 (22.9-100.3)	<0.0001
Ejection fraction (%)	48.8±10.1 (14.9-73.2)	49.6±8.9 (24.1-73.2)	47±12.3 (14.9-70.9)	0.037
Mass index (g/m <sup>2</sup> )	43.5±15.7 (17.1-143.4)	42.2±13.9 (17.1-105.9)	46.3±18.9 (17.2-143.4)	0.039
Mass/volume ratio	0.31±0.1 (0.13-0.96)	0.3±0.1 (0.1-0.6)	0.4±0.1 (0.2-1.0)	<0.0001
Pulmonary regurgitation (%)	33.3±17.9 (0-75)	37.6±16.9 (0-75)	23.4±16.1 (0-59)	<0.0001
<b>LV Variables</b>				
EDV index (ml/m <sup>2</sup> )	83.6±18.4 (42.3-196.9)	82.7±16.3 (52.8-158)	85.7±22.6 (42.3-196.9)	0.21
ESV index (ml/m <sup>2</sup> )	33.52±11.1 (13.27-98.85)	32.9±10.6 (13.3-93.1)	34.8±11.9 (16.3-98.8)	0.16
Stroke volume index (ml/m <sup>2</sup> )	50.1±11.3 (25.3-125.6)	49.8±9.8 (25.4-88.6)	50.9±14.2 (25.3-125.6)	0.47
Ejection fraction (%)	60.3±7.1 (31.5-79.5)	60.6±7.2 (34.3-79.5)	59.5±6.7 (31.5-71.2)	0.22
Mass index (g/m <sup>2</sup> )	63.1±16.3 (33.9-152.8)	62.7±14.9 (33.9-133.5)	64.2±19.2 (36-152.8)	0.48
Mass/volume ratio	0.77±0.17 (0.46-1.26)	0.8±0.2 (0.5-1.3)	0.8±0.2 (0.5-1.1)	0.62

**CONCLUSION:** These data characterize the range of biventricular dimensions and function in patients with repaired TOF and allow clinicians to determine how individual patients compare with their peers.