

POSTER PRESENTATION

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Obesity leads to underestimation of ventricular volumes and abnormal myocardial strain in repaired Tetralogy of Fallot as measured by cardiac MRI

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Background

Obesity is an increasing epidemic that has not spared children and adults with congenital heart disease. Patients with repaired tetralogy of Fallot with trans-annular patch (rTOF-TAP) have significant pulmonary insufficiency and right ventricular (RV) enlargement. Recommendations for pulmonary valve replacement (PVR) include body surface area (BSA)-indexed RV end diastolic volume (RVEDVi) >150 ml/m² or indexed RV end systolic volume (RVESVi) >80 ml/m², estimated by cardiac MRI (CMR). We hypothesized that: 1) overweight and obese patients with rTOF-TAP have underestimated indexed ventricular volumes when compared to volumes indexed to ideal BSA and 2) these patients have altered parameters of cardiac function compared to weight appropriate patients.

Methods

Retrospective review of 86 patients from 2009-2013 with rTOF-TAP who underwent CMR. Mean age 20.1 years (\pm 10.9). Patients assigned weight categories by Center for Disease Control guidelines for children and adults based on body mass index (BMI): appropriate weight (n = 51), overweight (n = 23), and obese (n = 12). CMR analysis included: 1) RV volumes and RV ejection fraction (RVEF); 2) Left ventricular (LV) volumes and LVEF; 3) Peak circumferential LV strain (ϵ_{cc}) using HARP analysis of myocardial tagged images. Overweight and obese patients assigned ideal BSAs to recalculate indexed RV volumes. Mann-Whitney U was used to compare continuous variables between groups.

Results

Mean BMI in appropriate weight 19.8 kg/m², overweight 26.4 kg/m², obese 33.5 kg/m². Obese and overweight patients had significantly larger absolute RVEDV and LVEDV compared to weight appropriate patients (RV mean 234 ml vs. 200 ml, p = 0.014; LV mean 113 ml vs. 92 ml, p = 0.002). No significant difference in RVEF and LVEF among groups. When RV volumes were corrected for ideal BSA, 11 (31%) additional overweight and obese patients met standard criteria for PVR referral (Figure 1); mean change RVEDVi 22.9 ml/m² (range 4.8-62 ml/m²), mean change RVESVi 11.3 ml/m² (range 2.9-38.4 ml/m²). There was a statistically significant difference between ϵ_{cc} in appropriate weight (-17.3%) and obese (-14.3%) patients, (-2.94%, 95%CI{-5.2,-0.6} p = 0.007) (Figure 2); segmental analysis between appropriate weight and obese patients demonstrated decreased ϵ_{cc} in anteroseptal, inferior, and inferolateral segments (p < 0.001, p = 0.003, p = 0.016, respectively). No significant differences in ϵ_{cc} noted between appropriate weight and overweight patients.

Conclusions

Increased BMI leads to the underestimation of indexed RV volumes, possibly affecting timing of PVR. This underestimation should be corrected using ideal BSA. Decreased LV ϵ_{cc} has not been previously reported in obese patients with rTOF-TAP. Although clinical implications of abnormal ϵ_{cc} are unclear, these patients may be at higher risk for early LV dysfunction. Further studies on ϵ_{cc} in this patient population are recommended.

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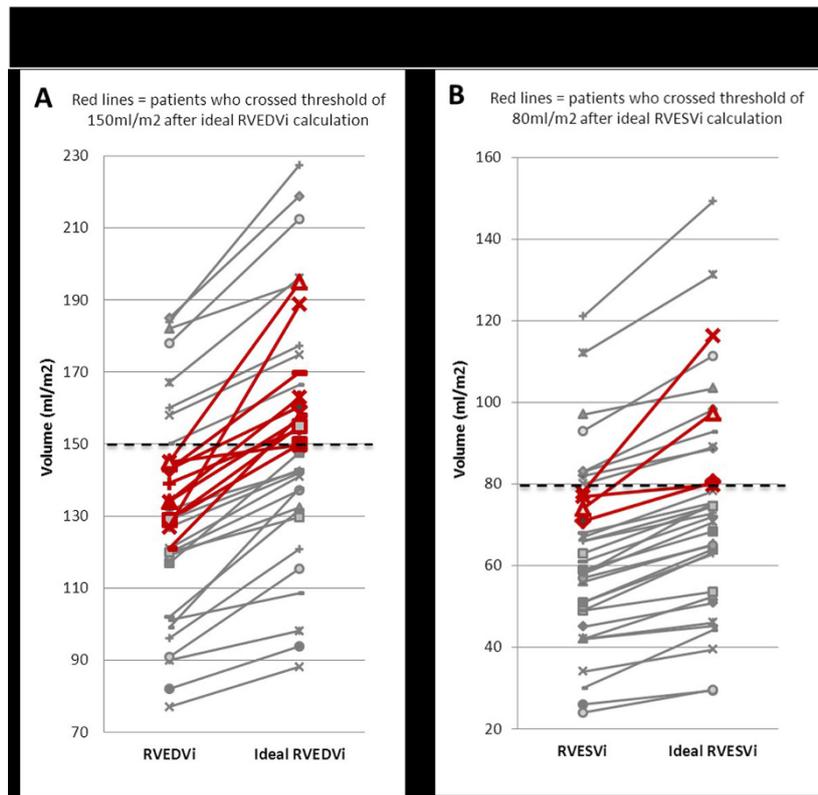


Figure 1

Figure 2: Peak Global Circumferential LV Strain in rTOF-TAP

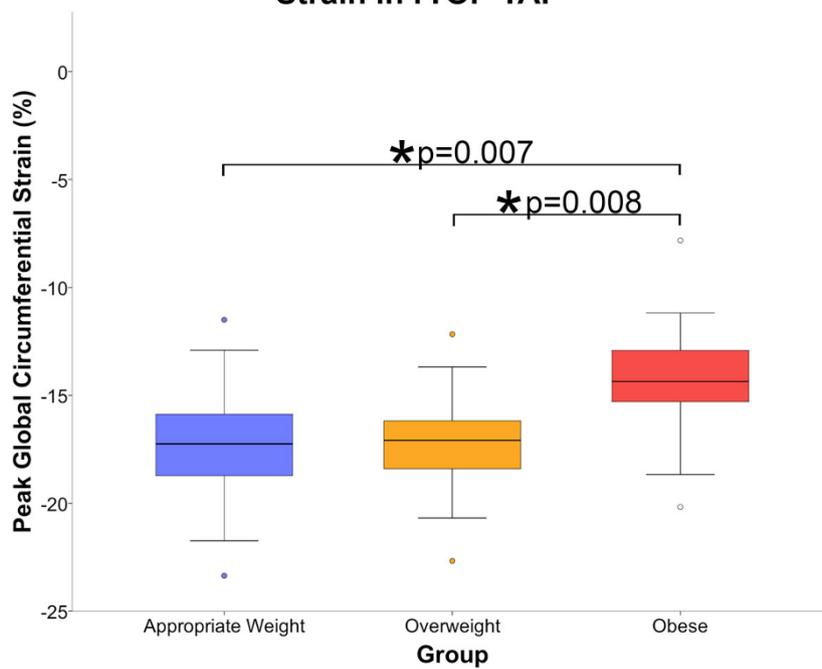


Figure 2 Peak global circumferential LV strain in rTOF-TAP.

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