

## Left Ventricular Morphology and Function in Adolescents with Severe Obesity: A Cardiac MRI Study

### Abstract Track #1: Metabolism and Integrative Physiology

Wesley J. Tucker<sup>1</sup>, Michael D. Nelson<sup>1</sup>, Patrick J. Bolan<sup>2</sup>, Aaron S. Kelly<sup>3,4</sup>, Justin R. Ryder<sup>3,4</sup>

<sup>1</sup>Department of Kinesiology, University of Texas at Arlington, Arlington, TX, USA; <sup>2</sup>Center for Magnetic Resonance Research, Minneapolis, MN, USA; <sup>3</sup>Department of Pediatrics, University of Minnesota Medical School, Minneapolis, MN; <sup>4</sup>Center for Pediatric Obesity Medicine, University of Minnesota Medical School, Minneapolis, MN.

**Background:** Adolescents with severe obesity are at elevated risk of developing cardiovascular disease; however, the exact mechanisms are unknown. We tested the hypothesis that adolescents with severe obesity would present with adverse ventricular remodeling and dysfunction, which would be exacerbated under physiological stress compared to matched, normal-weight peers.

**Methods:** Five adolescents with severe obesity (16±2yrs, 37.1±6.2kg/m<sup>2</sup>, 3 females) and eight normal-weight controls (17±2yrs, 22.4±2.2 kg/m<sup>2</sup>, 1 female) underwent resting and stress cardiac magnetic resonance imaging. Stress was 5-7 min of isometric handgrip exercise at 40% maximum voluntary contraction. Left ventricular (LV) morphology and global function was assessed using short and long axis cine images. Circumferential and longitudinal strain and diastolic strain rates were assessed using tissue tracking. Mitral inflow velocity was measured with phase contrast images. Group differences were assessed using t-tests.

**Results:** Novel findings were three-fold: 1) Adolescents with severe obesity had lower LV mass to volume ratio (0.56±0.11 vs. 0.69±0.10, p=0.045), compared to normal-weight, which was driven by lower LV mass index (46.8±11.6g/m<sup>2</sup> vs. 61.3±9.4g/m<sup>2</sup>, p=0.03); 2) LV diastolic function was impaired with severe obesity, as evidenced by slower circumferential (1.30±0.16s<sup>-1</sup> vs. 1.81±0.32s<sup>-1</sup>, p=0.003) and longitudinal early diastolic strain rates (0.94±0.08s<sup>-1</sup> vs. 1.28±0.48s<sup>-1</sup>, p=0.08), and lower early mitral inflow velocity (403±83ml/sec vs. 518±91ml/sec, p=0.04), which peaked later in relation to the R-wave (515±34s vs. 455±25s, p=0.004); 3) Despite similar rate pressure products during handgrip stress (p=0.80), circumferential strain was significantly impaired with severe obesity when compared to normal-weight (+4.2±4.0% vs. -0.8±2.7%, p=0.045).

**Conclusion:** Adolescents with severe obesity show early signs of adverse eccentric remodeling and ventricular dysfunction both at rest and during stress.

**Keywords:** isometric handgrip, diastolic function, strain.