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Cardiovascular Disease in Women

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Background: Sex differences have been intensely investigated during the development of pressure overload (PO; e.g. aortic stenosis, arterial hypertension)-induced left ventricular (LV) myocardial hypertrophy (LVH). However, it is less clear whether sex-related differences also affect the regression of pathological LVH after pressure unloading.

Purpose: Therefore, we investigated the potential influential effect of sex on myocardial reverse remodeling in a relevant rat model of banding and debanding of the abdominal aorta.

Methods: PO of the left ventricle was induced in male (M) and female (F) rats by abdominal aortic banding (AB) for 6 or 12 weeks. Sham operated animals served as controls. Pressure unloading was evoked by removing the aortic constriction at week 6 (debanding). Serial echocardiography was performed to detect temporal alterations in LV morphology and geometry. Furthermore, distinct aspects of LV systolic and diastolic function were assessed by pressure-volume analysis. Structural changes, such as cardiomyocyte hypertrophy and interstitial fibrosis were measured on histological sections. Fetal gene expression (a molecular marker of pathological LVH) was analyzed by quantitative real-time PCR.

Results: In both male and female AB rats, PO induced the development of marked LVH as confirmed by increased LV mass, heart weight-to-tibial length ratio (HW/TL [g/cm]: 0.47±0.01 AB-M vs. 0.36±0.01 Sham-M, p<0.05; 0.36±0.02 AB-F vs. 0.26±0.01 Sham-F, p<0.05) and cardiomyocyte diameter. Similarly, reactivation of fetal gene expression (indicated by increased atrial natriuretic peptide [ANP]) and enhanced interstitial collagen accumulation was also observed in male and female AB groups as well. The extent of myocardial hypertrophy was greater among female AB animals, while fibrosis was more severe in male AB rats. In both genders, LVH was associated with prolonged ventricular relaxation (active relaxation time constant, Tau [ms]: 19.6±0.8 AB-M vs. 13.1±0.4 Sham-M, p<0.05; 15.2±1.3 AB-F vs. 12.2±0.3 Sham-F, p<0.05). However, systolic function was impaired only in males (ejection fraction, [%]: 44.4±2.3 AB-M vs. 57.5±2.1 Sham-M, p<0.05; 49.7±2.2 AB-F vs. 53.4±1.7 Sham-F, n.s.). Contrary to the sex-dependent differences during the development of LVH, removing the aortic constriction resulted in a comparable degree of reverse remodeling on the morphological (decreased LV mass, HW/TL), histological (decreased CD and interstitial fibrosis), molecular (reduced ANP expression) and functional (recovered ejection fraction and Tau) levels in both male and female rats.

Conclusion: Pressure unloading at a relatively early time point leads to myocardial reverse remodeling to a comparable degree in male and female rats.