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### Age Comparisons of Cardiac Work During Exercise in Women: Insight from Acute $\beta$ -1 Adrenergic Blockade

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Postmenopausal women exhibit exaggerated increases in blood pressure during activities of daily living and exercise. The decreased size and increased stiffening of postmenopausal women's hearts elevate myocardial oxygen demand when compared to age-matched men and younger cohorts. Together, this poses a risk to the safety of, and capacity for, exercise in postmenopausal women. We recently studied the effects of esmolol, a fast-acting, cardio-selective  $\beta$ -adrenergic antagonist, on oxygen transport variables during dynamic exercise in healthy young and older women to better understand differences in cardiovascular responses to exercise. **PURPOSE:** To determine the effects of acute cardiac specific blockade on myocardial oxygen demand and cardiac work in healthy young premenopausal and older postmenopausal women. **METHODS:** Thirteen healthy young (Y) (20-32 yr) and older postmenopausal (O) (58-70 yr) women performed moderate (MOD) (85% of lactate threshold (LT)) and heavy (HVY) (50% between LT and the respiratory compensation point) recumbent leg cycling exercise during IV infusion of saline (S) or esmolol (E) in randomized order. Brachial blood pressure (BP, automated cuff), heart rate (HR), and cardiac output (CO, bioimpedance) were measured continuously. Myocardial demand (RPP,  $HR \times$  systolic BP), cardiac work (CW,  $CO \times$  MAP), and relative cardiac work (CW/W,  $CO \times$  MAP/Watts) were calculated. Repeated measures ANOVAs were used to determine the effect of exercise intensity, drug treatment, and age. **RESULTS:** Power outputs were lower in O vs. Y at both MOD ( $45 \pm 9W$  and  $72 \pm 15W$ ,  $p < 0.001$ ) and HVY ( $81 \pm 21W$  vs.  $117 \pm 32W$ ,  $p < 0.001$ ). During the saline trial CO was lower ( $p < 0.001$ ), and MAP was RPP were higher ( $p < 0.001$ ) in the O vs Y group during both intensities. There was a main effect of treatment; E reduced CO, MAP, and CW in O and Y. There was a significant effect of age\*treatment on CW/W; pairwise comparisons revealed CW/W was higher in O in both treatments and CW/W decreased to a greater extent in O vs. Y ( $-4.2 \pm 0.7$  vs  $-2.1 \pm 0.7$ ,  $p = 0.039$ ). **CONCLUSION:** Older postmenopausal women perform more cardiac work per watt of dynamic leg exercise compared to younger women. Beta blockade reduces cardiac work in postmenopausal women more than young women. **SIGNIFICANCE/NOVELTY:** Acute  $\beta$ -1 adrenergic blockade narrows the gap between central cardiovascular function in young and old women and provides a powerful tool to investigate age-related cardiovascular differences.

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