Stress Testing for Diastolic Dysfunction: An Old Approach to a New Question

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ABSTRACT

BACKGROUND: Currently, conventional cycle echocardiography is the recommended method for diagnosing diastolic dysfunction in patients with unexplained dyspnea upon exertion. However, this method has several underlying limitations including movement and respiratory artifact. These limitations are often exaggerated in patients who are obese and suffer from exertional dyspnea, and therefore limit its application in clinical diagnosis. Our group recently demonstrated that isometric handgrip echocardiography is a powerful sub-clinical diastolic discriminator that avoids the limitations of conventional cycle echocardiography and that can be easily implemented in the clinic. **PURPOSE:** However, to date it remains unclear how these two methodologies compare, and thus was the focus of the present investigation. We hypothesized that isometric handgrip echocardiography would be a more robust method for unmasking exercise induced diastolic dysfunction compared to conventional cycle echocardiography, due to its markedly different hemodynamic load. **METHODS:** To test this hypothesis, we recruited 24 individuals from the community (9 male, 15 female, age range: 18 - 80), who all performed 3 minutes of isometric handgrip echocardiography followed by 3 minutes of dynamic cycle exercise (20 W). At rest and during the final minute of each exercise protocol heart rate (HR), mean arterial pressure (MAP) and Doppler derived E/e' were recorded. Consistent with our previous work, and that of others, individuals who had a change in E/e' from rest to exercise of >1.5 (ΔE/e' > 1.5) were defined as responders, while non-responders were defined as ΔE/e' < 1.5. **RESULTS:** Both isometric handgrip and low-intensity cycle exercise resulted in a similar rise in HR (ΔHR: 22 ± 13 *vs*. 25 ± 7, handgrip vs. cycle exercise, $P > 0.05$), while isometric handgrip resulted in a larger increase in MAP (ΔMAP: 28 ± 14 *vs*. 16 ± 12, handgrip vs. cycle exercise, $P = 0.0003$). Remarkably, the increased afterload stress experienced by the myocardium during isometric handgrip exercise was more robust at unmasking sub-clinical diastolic dysfunction in asymptomatic elderly individuals compared to conventional cycle exercise (handgrip: $n = 14$ *vs*. $n = 10$; and cycle: $n = 10$ *vs*. $n = 14$, responders *vs*. non-responders). **CONCLUSION:** Taken together, these data highlight the usefulness of isometric handgrip echocardiography at isolating myocardial diastolic relaxation abnormalities in community dwelling individuals, beyond that of dynamic cycle exercise. Future work should focus on confirming the sensitivity of this method in individuals at risk for or with diagnosed heart failure.