

Aortic Wave Reflection Following Maximal Exercise in Healthy Young Adults

KENG-YU CHANG, ZHAOLI LIU, & CHUEH-LUNG HWANG

Cardiovascular Laboratory of Health; Department of Kinesiology; University of Texas at Arlington; Arlington, TX

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Advisor / Mentor: Hwang, Chueh-Lung (chueh-lung.hwang@uta.edu)

ABSTRACT

Increased magnitude and early return of aortic wave reflection decrease coronary perfusion during diastole and augment systolic blood pressure (SBP). Exaggerated SBP in responses to maximal exercise is an indicator of future cardiovascular disease. Several studies investigated aortic wave reflection in response to maximal exercise. However, most of these studies did not provide a comprehensive assessment of wave reflection, including the forward and backward components of the pressure waves. The former are generated by ventricular contraction and the latter are the function of forward waves and waves reflected from the periphery. **PURPOSE:** This study was to investigate aortic wave reflection in response to maximal exercise using wave separation analysis. **METHODS:** Twenty-eight healthy young adults (17 male, age: 28 ± 4 yrs, body mass index: 24.0 ± 2.6 kg/m²; mean \pm SD) underwent maximal graded cycle ergometry tests. Aortic wave reflection was assessed at pre-exercise and immediately after the exercise (0-5 min). Using a cuff-based SphygmoCor device (XCEL, AtCor Medical), aortic SBP, pulse pressure (PP), and augmentation pressure (AP) were derived from the aortic pressure waveforms generated from the brachial pressure waveforms. Augmentation index (AIx), expressing AP as a percentage of PP, was then calculated. Aortic pressure waveforms were separated into forward (Pf) and backward pressure waves (Pb). Reflection magnitude (RM) was calculated as Pb divided by Pf \times 100%. **RESULTS:** After exercise, aortic SBP and PP increased ($P=0.021$ and $P=0.016$ respectively), while AP (5 ± 4 to 4 ± 5 mmHg, $P=0.017$) and AIx decreased (13.2 ± 9.9 to $9.5 \pm 12.0\%$, $P=0.022$). Both Pf (26 ± 4 to 34 ± 6 mmHg, $P=0.002$) and Pb (13 ± 3 to 15 ± 2 mmHg, $P=0.015$) increased, but RM was decreased following exercise (49.0 ± 7.0 to $43.6 \pm 5.9\%$, $P=0.036$). After exercise, aortic SBP was positively associated with Pf ($B=0.57$, $P=0.002$), but not Pb, AP, AIx, and RM ($P \geq 0.2$). **CONCLUSION:** Our findings suggested that in young healthy adults, increased SBP following maximal exercise may be primarily due to increased ventricular contraction. Although the magnitude of wave reflection increases following maximal exercise, this reflected wave may arrive relatively later within a cardiac cycle, which may benefit coronary perfusion instead of causing exaggerated SBP. This study helps extend our understanding of aortic hemodynamics during maximal exercise.