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Aortic distensibility decreases during exercise in normal volunteers

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Introduction

Aortic distensibility is a validated and prognostically useful measure of central arterial stiffness, which increases in a number of altered physiological states including aging, obesity, atherosclerosis and hypertension. We describe the changes observed in aortic distensibility, in normal individuals, during brief vigorous exercise.

Methods

24 healthy volunteers (17 males, mean age 35) underwent magnetic resonance imaging in the supine and prone position using a 1.5 T CMR system (Siemens) at rest. Imaging was then repeated immediately after 2-6 mins of prone lower limb exercise, and again after 4 minutes of recovery. Aortic cross-sectional area was measured at the ascending aorta and proximal desending aorta (at the level of the bifurcation of the pulmonary artery) and at the descending abdominal aorta (12-14 cm below this plane) throughout the cardiac cycle. BP was measured simultaneously. Aortic distensibility was defined as (maximum aortic area - minimum aortic area/minimum aortic area)/pulse pressure. Two-sided, paired t-tests for pre- and post-exercise distensibility were undertaken using SPSS, and data presented as means with standard deviations.

Results

Distensibility at each location was not significantly different in the prone position compared to the supine position (ascending aorta 4.5 v 4.4 $mmHg^{-1}$ p = 0.965, proximal descending aorta 5.2 v 4.7 $mmHg^{-1}$ p = 0.281, distal descending aorta 7.0 v 6.7 $mmHg^{-1}$ p = 0.750).

Resting distensibility in the distal descending aorta was 45% higher compared to the ascending aorta (p = 0.002) and 36% higher compared to the proximal descending aorta (p = 0.001). There was no significant difference in distensibility at rest between the ascending and proximal descending aorta.

During exercise, distensibility decreased by 25% in the ascending aorta (p = 0.005), 36% in the proximal descending aorta (p < 0.0005) and 30% in the distal descending aorta (p = 0.0007) (see figure).

Distensibility returned to pre-exercise levels after 4 mins of recovery at all three aortic sites.

Conclusion

Aortic distensibility measured at the ascending, proximal descending and distal descending aorta decreases during brief vigorous lower-limb exercise, by 25%, 36% and 30% respectively, in healthy individuals. The fall in aortic distensibility with exercise which we demonstrate may prove to be an early and sensitive measure of aortic stiffness in patho-physiological states