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Influence of High-Intensity Exercise on Aortic Stiffness and Femoral Artery Shear Patterns

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Aortic stiffness is linked to atherogenic retrograde and oscillatory shear patterns in peripheral arteries. High-intensity exercise may increase aortic stiffness. Whether such acute changes in aortic stiffness detrimentally affect peripheral shear patterns remains unknown. **PURPOSE:** Determine if acute changes in aortic stiffness negatively influences superficial femoral artery (SFA) shear rates (SR) and stiffness following high-intensity cycling. **METHODS:** 20 adults (27±5 yrs; 10 women) underwent arterial assessment at baseline (BL), after a 5-min time control period (TC), and following a 30-sec bike sprint against 7% body mass (POST). Aortic stiffness was measured using carotid-femoral pulse wave velocity (cfPWV). SFA diameter, blood velocity, and stiffness (β stiffness and Young's elastic modulus, ϵ) were measured via Doppler ultrasound. Diameters and blood velocities were used to determine SFA antegrade and retrograde SR as well as the oscillatory shear index (OSI). **RESULTS:** BL and TC were not different for any measures ($p>0.05$). cfPWV increased POST compared with BL and TC ($p\leq 0.01$). SFA retrograde SR and OSI were reduced POST compared with BL and TC ($p\leq 0.001$). SFA stiffness was unchanged by exercise ($p\geq 0.06$). The change in cfPWV from pre-exercise to POST was not associated with changes in retrograde SR ($r = 0.03$, $p=0.90$), OSI ($r = 0.13$, $p=0.58$), β ($r = 0.07$, $p=0.78$), or ϵ ($r = 0.08$, $p=0.73$). **CONCLUSIONS:** Acute high-intensity exercise increases aortic stiffness while concomitantly reducing oscillatory shear in the SFA. High-intensity exercise-mediated increases in aortic stiffness appear independent from downstream atherogenic shear patterns in the exercised vasculature.

Table 1. Arterial stiffness and shear patterns before and after high-intensity cycling exercise.

	Baseline	Time Control	Post
<i>Stiffness Measures</i>			
Aortic cfPWV ($m \cdot s^{-1}$)	5.8 ± 0.6	5.7 ± 0.6	6.8 ± 1.3†
SFA β Stiffness (aU)	11.2 ± 2.8	13.6 ± 6.0	13.8 ± 4.6
SFA ϵ (kPa)	135.1 ± 7.8	157.0 ± 19.9	168.5 ± 12.7
<i>Shear Patterns</i>			
Primary Antegrade Shear Rate (s^{-1})	216.1 ± 68.7	200 ± 58.7	255.4 ± 55.5†
Retrograde Shear Rate (s^{-1})	88.4 ± 30.4	89.9 ± 25.5	41.2 ± 25.9*
Secondary Antegrade Shear Rate (s^{-1})	43.9 ± 8.8	42.1 ± 7.8	47.4 ± 36.1
Oscillatory Shear Index	0.25 ± 0.05	0.27 ± 0.04	0.11 ± 0.08*

cfPWV, carotid-femoral pulse wave velocity; SFA, superficial femoral artery; †Significantly different from pre-exercise ($p<0.05$); *Significantly different from pre-exercise ($p\leq 0.001$).