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Funding Source: National Institutes of Health, Office of Naval Research

Mental stress acutely affects blood flow mechanics in the abdominal aorta

Mental stress has deleterious cardiovascular effects and predicts adverse outcomes. However, detailed accounts of blood flow mechanics under mentally stressful conditions are lacking. The purpose of this study was to determine the effect of acute mental stress on abdominal aortic hemodynamics. Thirteen rabbits were chronically instrumented for measurement of blood velocity and pressure in the abdominal aorta. All measurements were taken at baseline and after two minutes of air jet-induced mental stress in conscious animals. On a separate occasion, the same rabbits were taken through a sham procedure as a control. Raw velocity and pressure waveforms were acquired at 100 Hz and analyzed offline by a blinded investigator. Recordings were filtered at 50 Hz, and 10-sec blocks of artifact-free data were selected for analysis. Waveforms were converted from the time to frequency domain via 256-point averaging FFT to yield corresponding velocity and pressure spectra. Impedance was calculated as the ratio of pressure to velocity moduli; characteristic impedance was taken as the average of all moduli above 5 Hz. The effect of mental stress on hemodynamic parameters was assessed via two-way repeated measures ANOVA. Acute mental stress increased heart rate ($P < 0.001$) and mean aortic flow velocity ($P = 0.042$), as well as aortic mean ($P < 0.001$), systolic ($P < 0.001$), diastolic ($P < 0.001$), and pulse pressures ($P = 0.002$). Stress also increased characteristic impedance ($P = 0.021$), a measure of aortic stiffness, but had no effect on resistance ($P = 0.208$) or reflection coefficient ($P = 0.224$). However, stress did increase the effect of wave reflection on diastolic ($P = 0.002$) and pulse ($P = 0.006$) pressures, but not systolic ($P = 0.666$) pressure. These results indicate that acute mental stress induces hemodynamic changes in the abdominal aorta.