

Exaggerated blood pressure responses to mental stress are associated with increases in muscle sympathetic nerve activity

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Elevated blood pressure (BP) responses to stressors in young people have been associated with greater risk of hypertension later in life. The aim was to determine what drives BP responses to stress in healthy young males. The time course of muscle sympathetic nerve activity (MSNA), BP and heart rate (HR) responses to mental stressors (Stroop colour-word test and mental arithmetic) and physical stressors (cold pressor test, static handgrip exercise, and post-exercise ischemia) were recorded in 21 healthy young (19-25-yr old) males. The physical stressor tasks elicited consistent increases in BP and total MSNA amongst subjects. The cold pressor task elicited significant peak increases from rest in mean arterial pressure (23 ± 3 mmHg, mean \pm SEM), total MSNA ($89 \pm 18\%$) and HR (10 ± 3 beats min⁻¹; $P < 0.05$). Assessment of the time course revealed that changes in BP during the cold pressor task were aligned with the increases in MSNA. The handgrip task elicited significant peak increases in mean arterial pressure (23 ± 3 mmHg), total MSNA ($27 \pm 9\%$) and HR (12 ± 2 ; $P < 0.05$). During the handgrip task, the changes in BP were paralleled by increases in both HR and MSNA. Due to large variability in BP responses to mental stress, subjects were divided into low (mean changes of < 10 mmHg) and high BP reactivity (mean changes of ≥ 10 mmHg) groups. Mental arithmetic elicited a significant increase in total MSNA in the high reactivity group ($34 \pm 11\%$; $P < 0.05$) but not in the low reactivity group ($24 \pm 11\%$; $P > 0.05$). There were significant increases in HR during the mental arithmetic test in the high reactivity group (15 ± 3 beats min⁻¹; $P < 0.05$), and in the low reactivity group (12 ± 3 beats min⁻¹; $P < 0.05$). The Stroop test was not associated with increases in total MSNA in either group, and elicited smaller increases in BP than the mental arithmetic task. We conclude that physical stressors are associated with consistent increases in blood pressure between individuals that are driven, in part, by increases in MSNA. Mental stressors are associated with greater inter-individual variability in BP responses; in high responders increases in MSNA appear to contribute to the large increases in BP during mental arithmetic.