

# Menopausal symptoms and sympathetic activity in post-menopausal females

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**Introduction:** Common symptoms of menopause include vasomotor symptoms (VMS; night sweats and hot flashes), exhaustion, depression, anxiety, and sexual dysfunction. Previous studies show that females who experience VMS may be at greater risk for hypertension (HTN) and cardiovascular disease (CVD) than those who do not have VMS. In addition, exaggerated blood pressure (BP) responses to stress, such as with a cold pressor test (CPT), can predict future HTN. However, it is unclear whether the experience of menopausal symptoms, rather than VMS specifically, contribute to HTN or CVD risk. Thus, the aim of our study was to determine if menopausal symptoms influence sympathetic reactivity to a CPT in postmenopausal females.

**Methods:** Six postmenopausal females (age  $61 \pm 2$ yr) attended two study visits. The first visit included written informed consent, completion of the Menopause-Specific Quality of Life questionnaire (MENQOL), and blood draws to measure sex hormone levels. The MENQOL asked participants to rate how bothered they felt in four areas of symptoms: vasovagal (i.e., VMS), psychosocial, physical, and sexual. The absence of a symptom corresponds with a score of 1 point, whereas a present symptom is rated according to how bothersome it is and is scored from 2-8 points. Participants were classified as NSYMP (non-symptomatic) or SYMP (symptomatic) based on their MENQOL scores. The second visit began after an overnight fast. During a five-min rest and a two-min CPT of the hand, continuous noninvasive BP, heart rate via three-lead electrocardiography (ADInstruments, Colorado Springs, CO), and muscle sympathetic nerve activity (MSNA) via microneurography were measured.

**Results:** Total MENQOL scores ranged from 1.3-2.4 on a 1-8 scale; physical symptom scores ranged from 1.1 to 2.7; and vasovagal symptoms (VMS) ranged from 1.0-1.7. Baseline MSNA incidence [bursts/100 heart beats (hb)] correlated with the MENQOL scores for physical symptoms ( $r=0.81$ ,  $p<0.05$ ), but not VMS ( $p>0.05$ ), indicating that physical symptom severity was correlated with resting sympathetic activity. Further, baseline MSNA was greater in females who had symptoms than in asymptomatic participants (SYMP:  $66 \pm 10$ , NSYMP:  $40 \pm 9$  bursts/100hb, 95% [CI: 17, 62],  $p = 0.03$ ). The different MSNA responses to CPT between the SYMP and NSYMP females (time x group,  $p=0.04$ ,  $\eta_p^2=0.79$ ) indicated that SYMP females had a smaller increase with CPT than NSYMP, likely due to the elevated MSNA baseline in the SYMP group compared to NSYMP. Mean arterial pressure (MAP) increased similarly in both groups (time x group,  $p=0.44$ ,  $\eta_p^2=0.16$ ). However, greater BP and sympathetic reactivity to CPT was not observed in SYMP than in NSYMP.

**Conclusion:** Females with menopausal symptoms had elevated resting sympathetic activity which was associated with severity of physical menopausal symptoms. However, in this small sample, females with menopause symptoms did not have an exaggerated BP and sympathetic reactivity to a stressor compared with females who do not experience symptoms.