

Baroreflex Sensitivity during Laboratory Stress and Relaxation Induction in Fibromyalgia Patients and their Healthy Acquaintances

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Background. Animal and human studies show an inverse relationship between blood pressure and sensitivity to painful stimuli. Baroreceptors within the aortic arc and carotid sinuses provide an important link between cardiovascular and pain regulatory systems.

Information on pressure changes registered by baroreceptors is relayed to brainstem areas that induce regulation of pain, blood pressure, and sleep by nucleus tractus Solitarius (NTS) reflex arc.

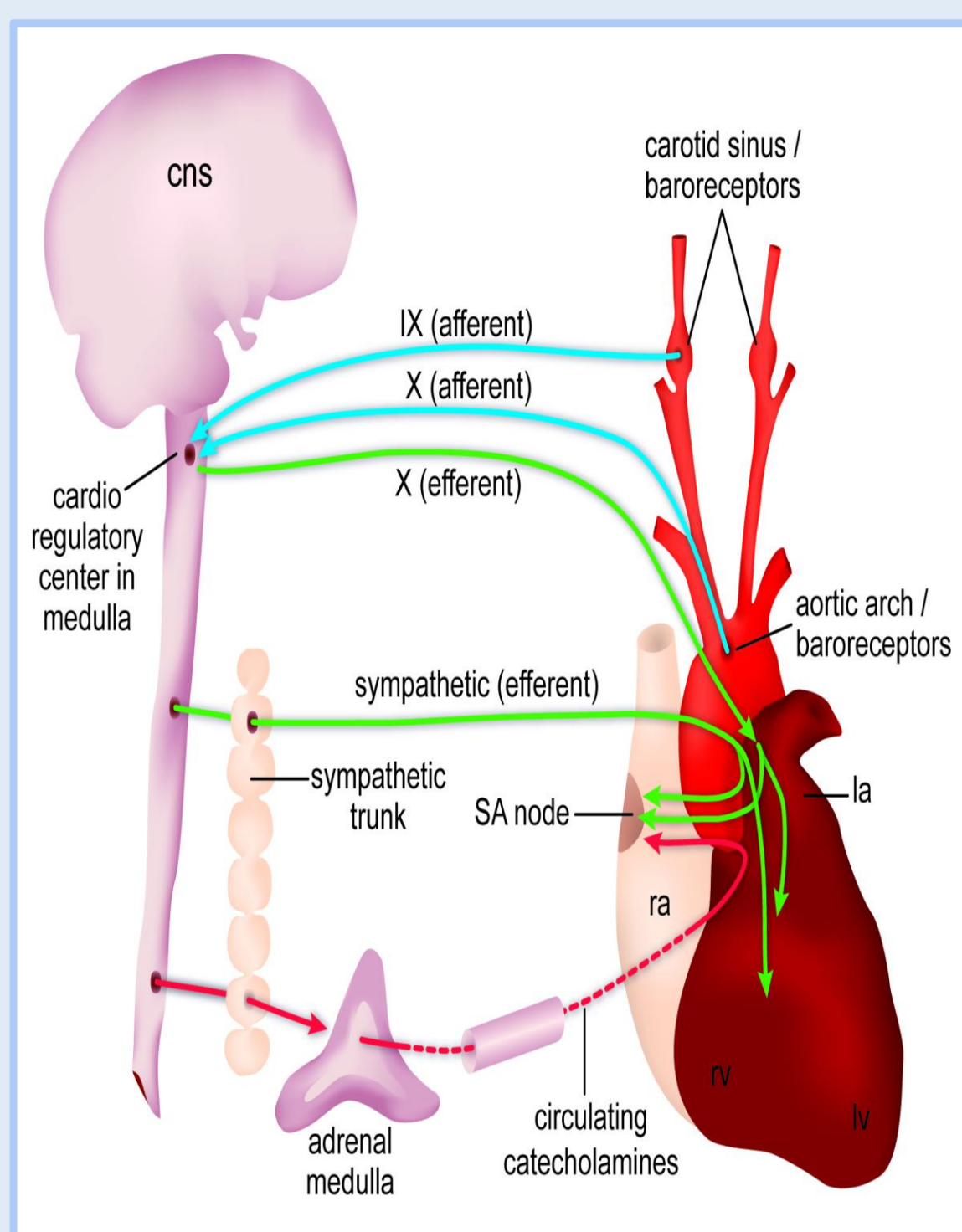


Fig. 1. Diagram of sympathetic and parasympathetic regulation of the baroreceptor reflex. la, left atrium; lv, left ventricle; ra, right atrium; rv, right ventricle; SA, sinuatrial. (McNeill et al., 2010)

Aims. In this study we examined blood pressure (BP), baroreflex sensitivity (BRS) and heart rate variability (HRV) in fibromyalgia (FM) patients and in their healthy acquaintances as controls (HC).

Methods. 34 FM patients and 36 HC participated in a 30 minutes psychophysiological session with baseline, alternating mental and physical stress, and three relaxation phases. Phase duration was 5 minutes each. Subjects rated subjective pain and stress levels after each phase. BP, BRS and HRV were recorded continuously.

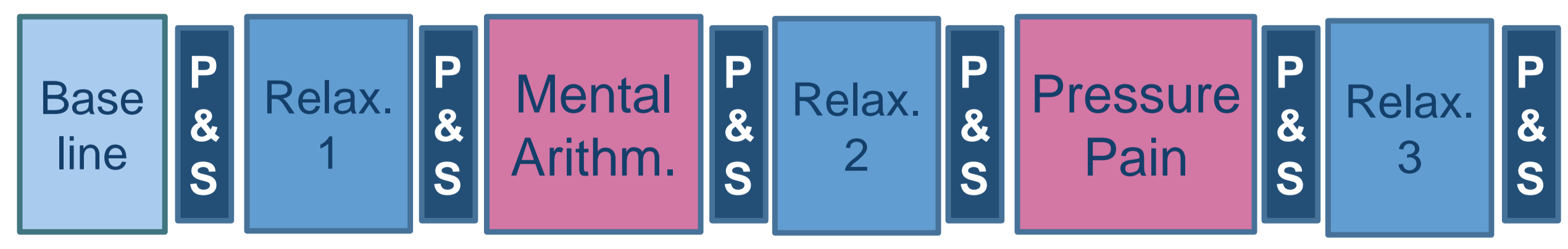


Fig. 2. Schematic display of session procedure, each phase lasting 5 minutes. "P&S" indicates subjective stress and clinical pain ratings.

Result 1 – Pain & Stress. FM patients reported significantly higher subjective pain in all phases (all p 's<0.01) and higher stress in all phases except baseline (all p 's<0.05) than HC. Both groups reported elevated stress in reaction to stress and pain induction and elevated pain in reaction to pain induction (all p 's<0.001).

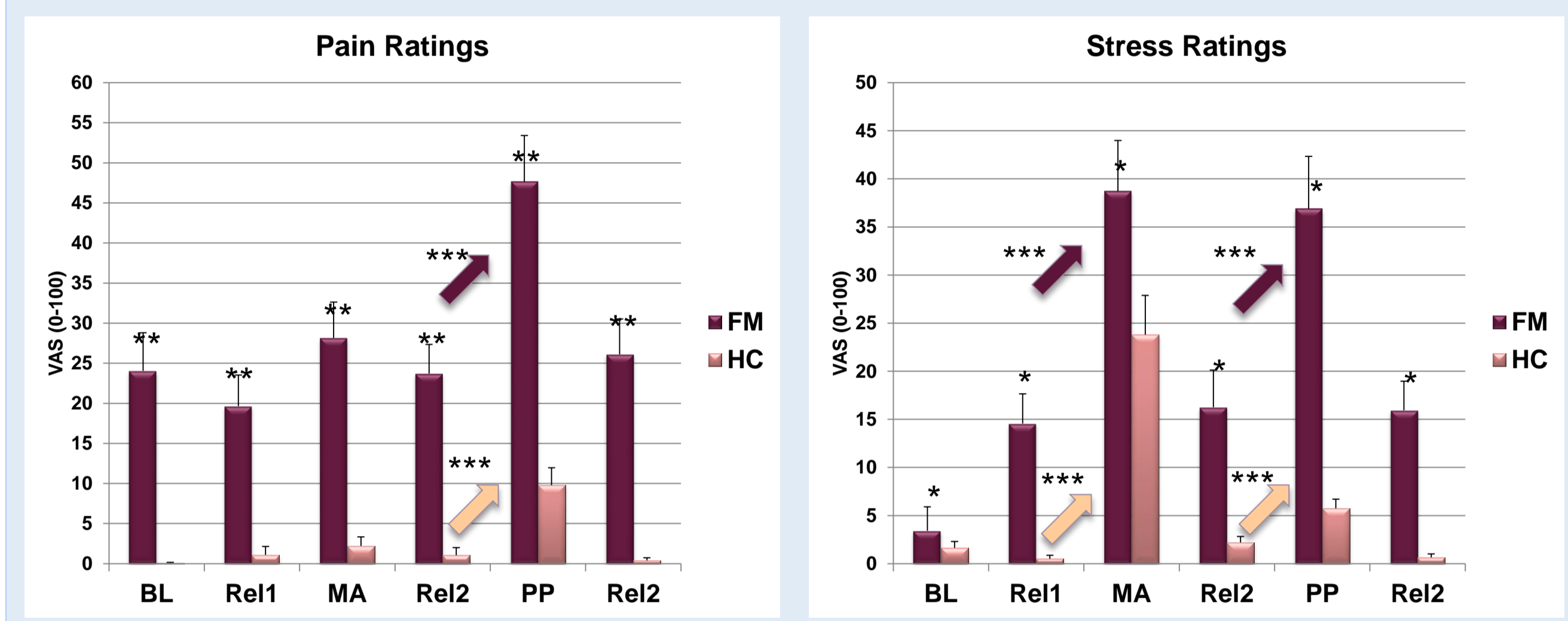


Fig. 3. Ratings of subjective pain (left) and subjective stress (right) by FM and HC on a VAS scale, taken after each of the 5 minutes phases respectively. Arrows indicate significant rise of the respective ratings from one phase to another.

Result 2 – BRS. FM showed a significant lower BRS compared to HC (all p 's<0.01). While HC show significantly higher BRS in stress than in relaxation phases, this pattern is reversed in patients (all p 's<0.01).

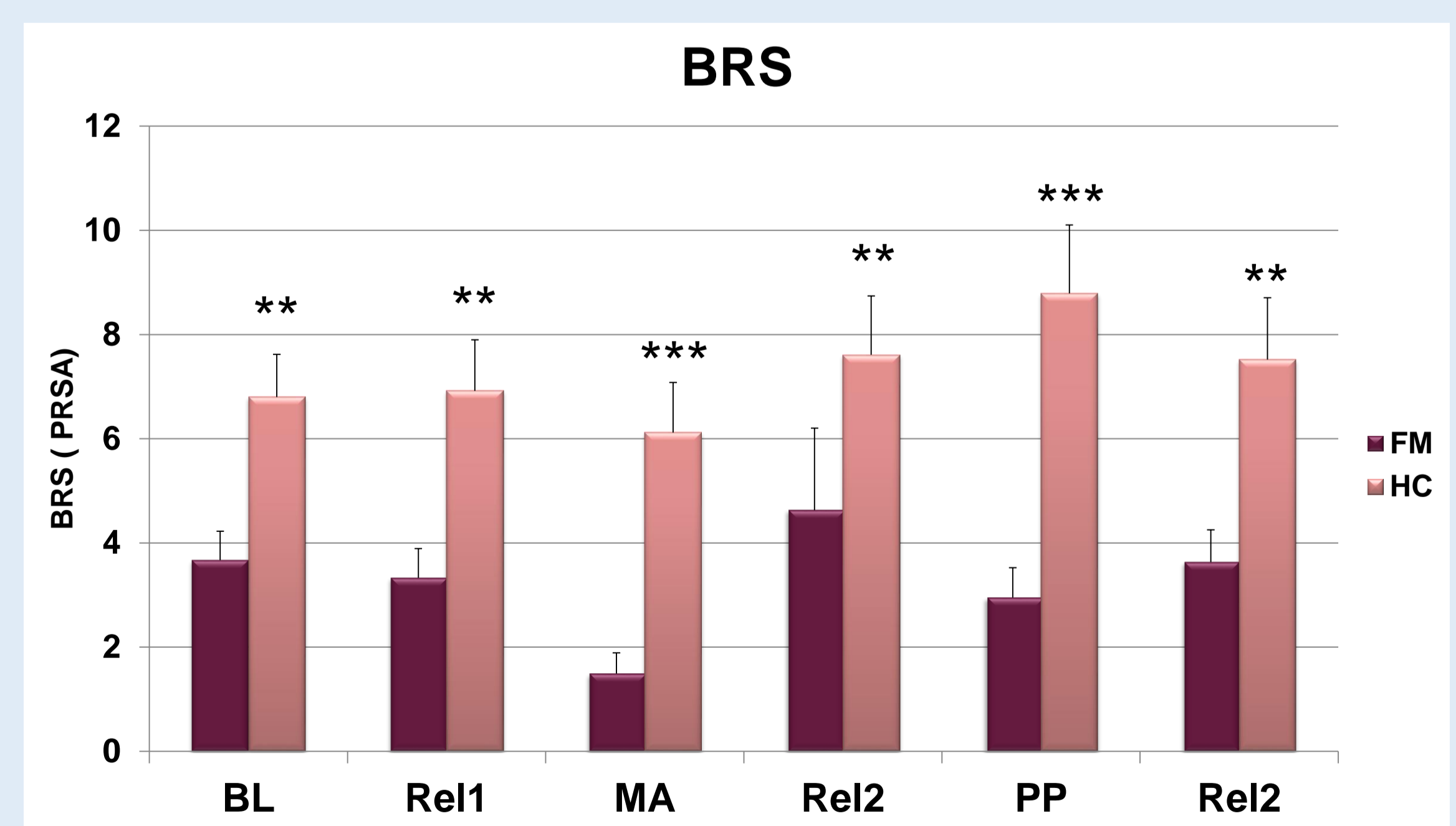


Fig. 4. BRS values for FM and HC during the different experimental phases. ** p <0.01 *** p <0.001

Result 3 – Blood Pressure. Systolic and diastolic blood pressure levels did not differ significantly between groups during all phases. Both FM and HC showed higher systolic and diastolic blood pressure in both stress phases compared to baseline and relaxation phases (all p 's<0.001).

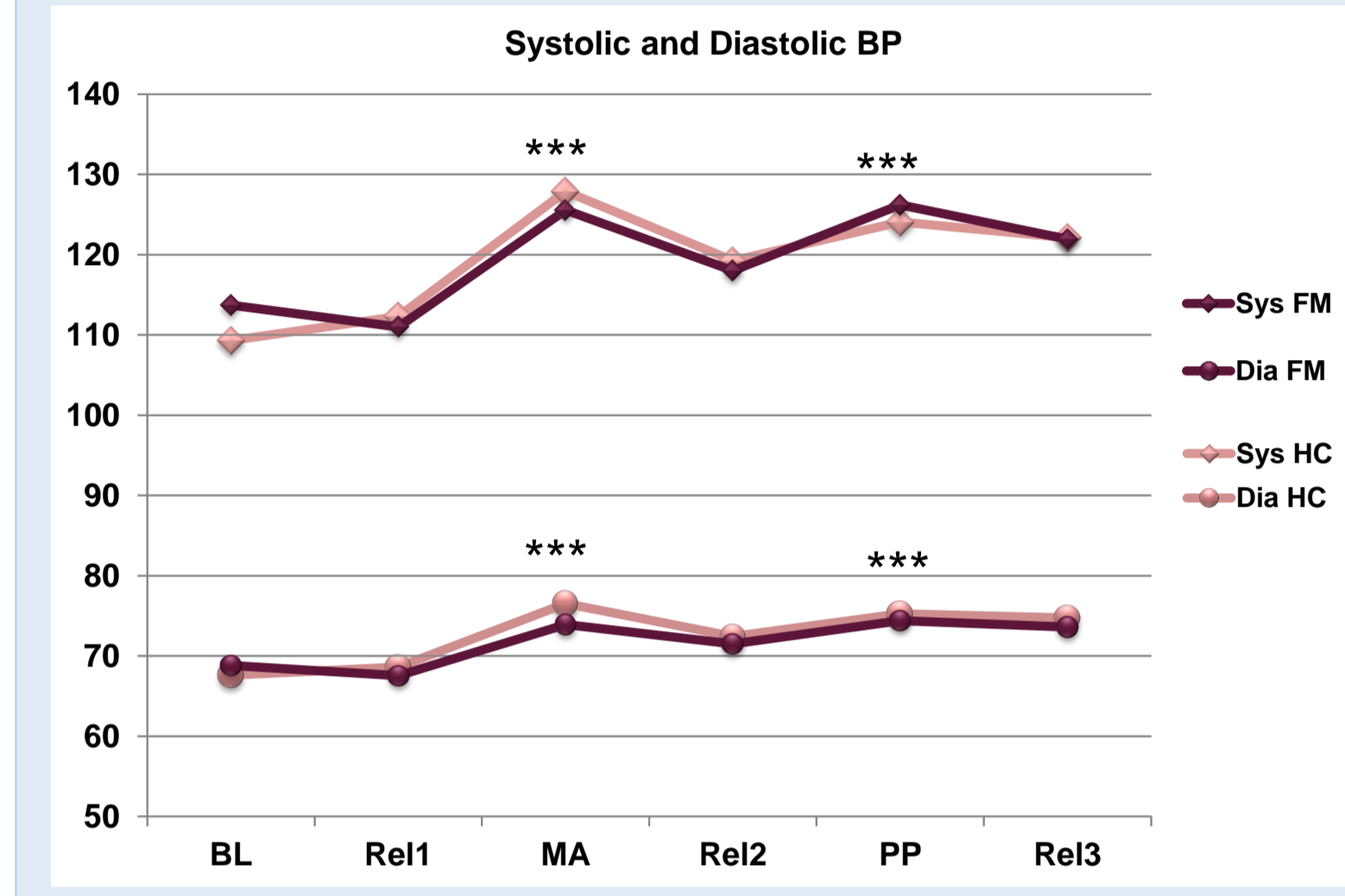


Fig. 4. Systolic (upper) and diastolic (lower) blood pressure during the course of the experiment for FM and HC. *** indicates significant difference to baseline and relaxation phases.

Result 4 – HRV. FM showed lower HRV, both LF and HF than HC during mental stress phases (all p 's<0.05). Whereas HC showed no significant differences between phases, FM showed lower \ln_{HFms^2} in MA and higher \ln_{HFms^2} in PP compared to baseline.

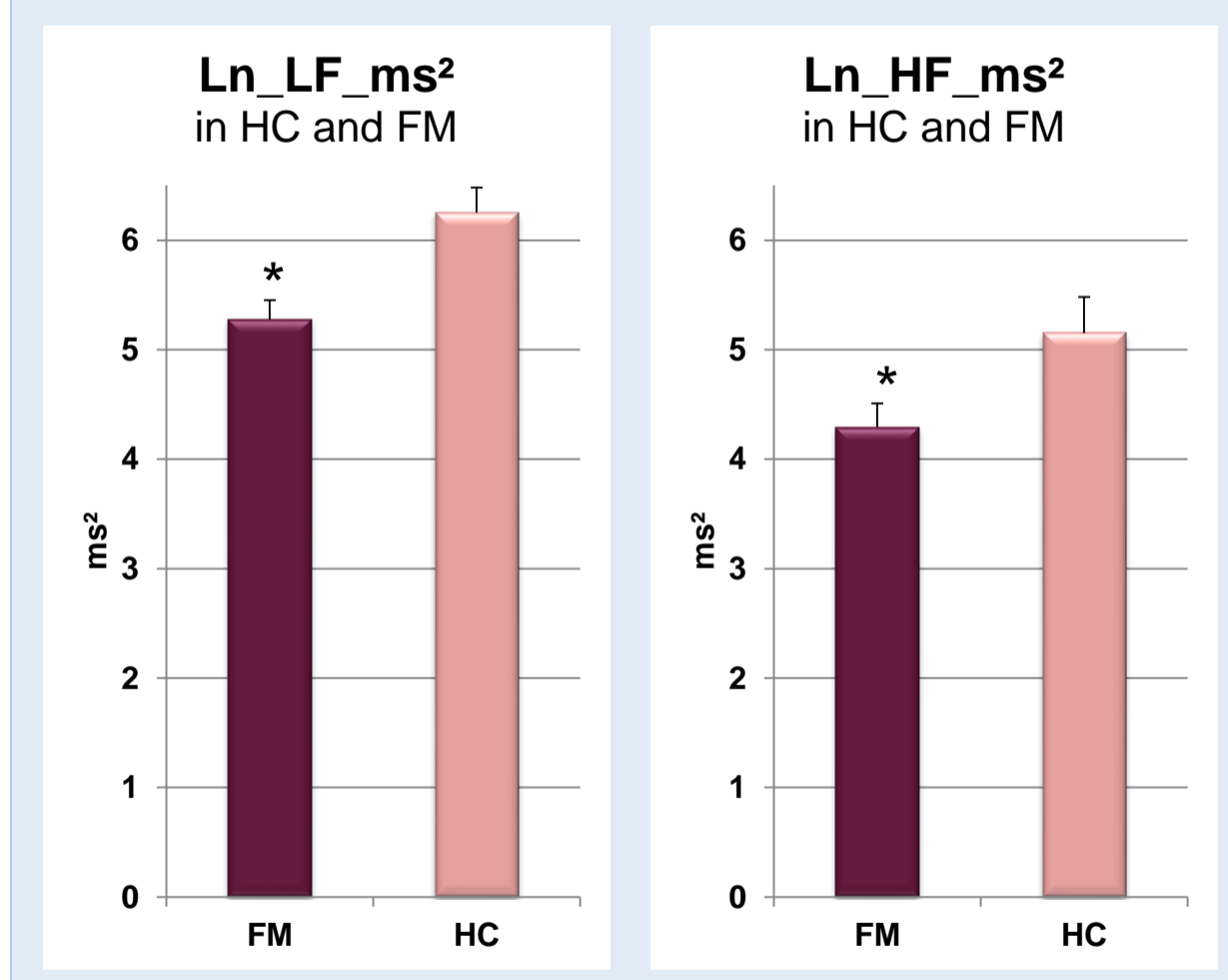


Fig. 5. Differences in \ln_{LFms^2} (left) and \ln_{HFms^2} (right) between HC and FM. HRV variables were log-normally distributed and therefore logtransformed.

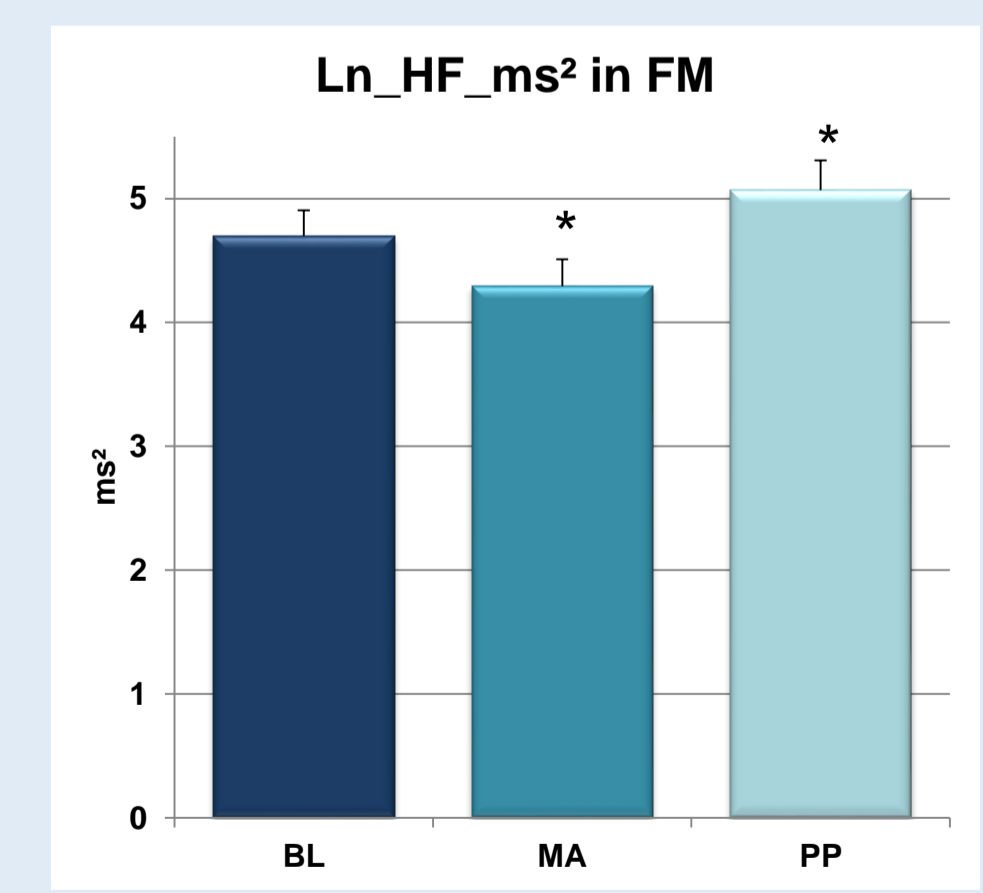


Fig. 6. Phase-dependent differences in \ln_{HFms^2} within the FM group. HRV variables were log-normally distributed and therefore logtransformed.

Conclusion. The decreased BRS and HRV suggest a dysfunctional NTS-reflex arc in fibromyalgia that may mediate the underlying etiology and maintenance in a hypertensive subgroup of FM and suggest a new treatment approach for this subgroup.