Active Standing Test Provokes Different Effects on the Variability of Diastolic and Systolic Electromechanical Subintervals

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We compared the effects of the active standing test (AST) on the variability of systolic and diastolic subintervals, which were estimated by measuring the electromechanical periods from the R wave peak (R) to the systolic peak (S) of the noninvasive arterial pressure waveform (RS), and from S to R (SR), respectively.

The time courses of the low-frequency components (LF_{RR}, LF_{SR}, and LF_{RS}) and the corresponding high-frequency components (HF_{RR}, HF_{RS}, HF_{SR}) of the RR, RS, and SR time series of 24 healthy volunteers who performed AST were computed using the smoothed pseudo-Wigner-Ville time-frequency distribution. Correlations, coherences, and ratios between the spectral indexes were also obtained. During AST, the response patterns of the indexes showed the following changes, relative to their baseline. RR and SR exhibited an abrupt fall maintained until the end, followed by an overshoot during recovery. LF_{RR} and LF_{SR} showed overshoots -one at the beginning and the other at the end of AST. HF_{SR} depicted an abrupt initial fall that was maintained until the end, followed by an overshoot during recovery. RS showed minuscule changes consisting of an initial increase followed by a decrease that recovered at the end. LF_{RS} displayed very small overshoots at the beginning and the end. HF_{RS} exhibited a tiny increment that was held until the end. During AST, the coherences and correlations of LF_{SR}-LF_{RR} and HF_{SR}-HF_{RR} relationships were very high (Table), with LF_{SR}/LF_{RR} ratio of 1.10±0.07 and HF_{SR}/HF_{RR} of 1.21±0.13. However, the corresponding values for LF_{RS}-LF_{RR} and HF_{RS}-HF_{RR} were smaller (Table), with LF_{RS}/LF_{RR} of 0.02±0.01 and HF_{RS}/HF_{RR} ratio of 0.05±0.06.

Our findings strongly support that AST induces almost identical modulatory effects of sympathetic increase and vagal decrease in both SR (diastolic) and RR series variabilities. In contrast, the sympathetic and vagal modulatory effects of AST on RS (systolic) series variability are negligible.

Table. Means ± SD of coherences and correlations of low-frequency (LF_{COH}, LF_{CORR}) and high-frequency (HF_{COH}, HF_{CORR}) components of the RS-RR and SR-RR relationships.

	LF_{COH}	HF_{COH}	LF_{CORR}	HF_{CORR}
RS-RR	0.715±0.110*	0.670±0.130*	0.641±0.219*	0.011±0.541*
SR-RR	0.996±0.003	0.993±0.007	0.995±0.007	0.996±0.005

*$p<0.0001$, RS-RR vs. SR-RR