Time-Courses of Central Frequencies of Low-Frequency Components of Systolic and Diastolic Pressures and RR Interval Variabilities in Response to Incremental Isometric Exercise

Alejandra Guillén-Mandujano, Salvador Carrasco-Sosa

Universidad Autónoma Metropolitana-I, CDMX, México

While there are few reports describing the effects of sympathetic maneuvers on the central frequency of the low-frequency component ($_{CF}$LF) of RR intervals ($_{CF}LF_{RR}$), there are none examining those of systolic ($_{CF}LF_{SP}$) and diastolic pressures ($_{CF}LF_{DP}$), nor the relation between them and their respective low-frequency powers ($_{P}LF_{RR}$, $_{P}LF_{SP}$ and $_{P}LF_{DP}$). Thus, we assessed, in 29 healthy subjects, the effects of continuously increasing muscular force (CIMF) by isometrically extending both legs at a rate of 0.2 $kg.s^{-1}$ until fatigue on the instantaneous 2-min time-courses of $_{P}LF_{SP}$, $_{P}LF_{DP}$, $_{P}LF_{RR}$, $_{CF}LF_{SP}$, $_{CF}LF_{DP}$ and $_{CF}LF_{RR}$, estimated by a time-frequency distribution. Comparisons and correlations between $_{CF}$LF and low-frequency power ($_{P}$LF) of the three variables were obtained. $_{P}$LF increment onset (threshold) was detected by V-slope method for response measures characterization into before (BTP) and after threshold (ATP) phases. For statistical analysis, 20-s epoch means (EM) of the dynamics were computed. Instantaneous time-courses of $_{CF}LF_{SP}$, $_{CF}LF_{DP}$ and $_{CF}LF_{RR}$ showed: 1. similar patterned responses of gradual increment in BTP and abrupt decrease in ATP, roughly inverse to the pattern presented by $_{P}$LF dynamics; 2. differences ($p<0.001$) in EM, with respect to control and among $_{CF}$LF according to the inequality: $_{CF}LF_{RR}>{}_{CF}LF_{SP}>{}_{CF}LF_{DP}$. $_{CF}$LF-$_{P}$LF correlations ($p<0.01$) of the three variables, shown in the table, were negative and greater ($p<0.01$) in ATP than BTP. The significant and characteristic changes elicited by CIMF in $_{CF}LF_{SP}$, $_{CF}LF_{DP}$ and $_{CF}LF_{RR}$, correctly indicate, but inversely, the known responses of reduction and abrupt increment of sympathetic activity before and after metaboreflex triggering. $_{CF}$LF indicating capability improves in ATP, by its substantially greater negative correlations. These findings imply that $_{CF}LF_{SP}$, $_{CF}LF_{DP}$ and $_{CF}LF_{RR}$ can be trustable sympathetic indicators that complement and strengthen the performance of autonomic activity spectral measures. The different $_{CF}$LF levels found suggest that the cardiac modulatory sympathetic effect presents greater frequency than the vasomotor one.

Table. Means±sd of $_{CF}$LF-$_{P}$LF correlations of SP, DP and RR in BTP and ATP. N=29.

	$_{CF}LF_{DP}$-$_{P}LF_{DP}$	$_{CF}LF_{SP}$-$_{P}LF_{SP}$	$_{CF}LF_{RR}$-$_{P}LF_{RR}$
BTP	-0.27±0.39	-0.28±0.36	-0.15±0.38
ATP	-0.70±0.27*	-0.49±0.60*	-0.67±0.39*

*$p<0.01$ between BTP and ATP