

Effects of Two Types of Linearly Increased Isometric Exercise on Instantaneous Baroreflex and Respiratory Sinus Arrhythmia Sensitivities Computed by Alpha Index

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The effects of non-stationary provocative maneuvers on baroreflex sensitivity (BRS) have been rarely studied. We aimed to evaluate the instantaneous BRS and respiratory sinus arrhythmia sensitivity (RSAS), both computed by alpha index, during the performance of two types of linearly increased until fatigue isometric exercise (LIFIE), handgrip (HG) and leg extension (LE), and their correlation with the muscular force (MF) produced. ECG, arterial pressure, respiration and MF were recorded in 35 healthy subjects during the performance, after a 1-min control period, of HG and LE linearly increased at a rate of 0.2 kg/s until fatigue. From the time-frequency spectra of R-R intervals (RR), systolic (SP) and diastolic pressures (DP) and respiration (Res) series, low-frequency (LF_{RR} , LF_{SP} , LF_{DP}) and high-frequency (HF_{RR} , HF_{Res}) powers were estimated. Instantaneous BRS and RSAS, assumed as input-output systems gains, were computed by alpha index and time-frequency coherences (cBRS, cRSAS). Averages of 20-s epochs of the variables dynamics were used for statistical analysis. Epoch means of the instantaneous response patterns, different from baseline ($p < 0.04$), of: BRS, cBRS, RSAS, cRSAS and RR progressively decreased; LF_{DP} , DP and HF_{Res} increased. Maximal MF was similar in LE and HG. Responses were greater in LE than HG ($p < 0.03$), excepting RSAS, HF_{Res} and LF_{DP} . Correlations of variables with MF are shown in the table. Both types of LIFIE provoke progressive and linearly correlated response patterns, mostly greater in LE than HG due to neural differences. Gradual decreases of: RSAS and cRSAS indicate progressive vagal withdrawal and loss of cardiac respiratory influence; BRS and cBRS allow the increase of sympathetic activity, shown by LF_{DP} and DP increases and RR shortening. RSAS and cRSAS, strongly correlated with MF in LE and HG, indicate the reduction of both gain and degree of coupling of the modulation, in frequency and amplitude, of respiration on RR series.

Table. Mean \pm SD of lineal correlations of MF with the obtained measures in HG and LE. N=35, * $p < 0.04$, LE vs. HG

	BRS ms/mmHg	cBRS	RSAS ms/au	cRSAS	RR ms	DP mmHg
LE	-0.63 \pm 0.26*	-0.48 \pm 0.27*	-0.81 \pm 0.23	-0.67 \pm 0.26	-0.84 \pm 0.11*	0.88 \pm 0.06*
HG	-0.40 \pm 0.43	-0.39 \pm 0.32	-0.87 \pm 0.12	-0.57 \pm 0.29	-0.73 \pm 0.13	0.76 \pm 0.09