Dynamics of Autonomic Activity during Mueller and Valsalva Maneuvers Assessed by Time-Frequency Analysis of Cardiovascular Variability

Salvador Carrasco-Sosa and Alejandra Guillén-Mandujano*

División de Ciencias Biológicas y de la Salud
Universidad Autónoma Metropolitana-I, DF, México

Our aims were: to compare the instantaneous dynamics of spectral measures of cardiovascular variability, estimated by a time-frequency distribution, during two opposite respiratory strains, Mueller (MM) and Valsalva maneuvers (VM); and to evaluate the relationships among systolic pressure (SP), RR intervals (RRi) and spectral indexes. ECG and arterial pressure were recorded in 24 healthy subjects during the performance of VM and MM. Power spectra of RRi and SP series were estimated using the smoothed pseudo Wigner-Ville transform to compute high-frequency power (HF), low-to-high-frequency ratio (LF/HF) and low-frequency power of SP (LFSP). During the strain of both maneuvers, HF decreased while LF/HF and LFSP increased. During the poststrain of both maneuvers, HF and LFSP rose and LF/HF returned to baseline. In both strain and poststrain, pooled means of spectral indexes were greater in VM than in MM ($p<0.01$). In early phase II of VM and late phase II of MM, mean correlations between SP and HF and between HF and RRi ranged from 0.82 to 0.91 ($p<0.001$). During late phase II, correlations between LFSP and SP ranged from 0.84 to 0.86 ($p<0.001$) in both maneuvers. Although Mueller and Valsalva are opposite respiratory maneuvers, the instantaneous dynamics of their spectral indexes are similar. In the strain, vagal activity decreases while both cardiac and vasoconstrictor sympathetic outflows increase, being these changes greater in VM than in MM. In the poststrain, vagal and vasoconstrictor sympathetic activities increase and cardiac sympathetic outflow decreases, with greater changes in VM. The strong correlations of HF with both SP and RRi support an important baroreflex participation in both maneuvers and provide a more robust estimate of the baroreflex function than the SP-RRi relation. The strong correlations between LFSP and SP indicate that the vasoconstrictor sympathetic outflow contributes in generating the SP overshoot, greater in VM than in MM.