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SHORT COMMUNICATION

Baroreflex Sensitivity as an Individual Characteristic Feature

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Summary

The reproducibility of baroreflex sensitivity (BRS in ms/mmHg; BRSf in mHz/mmHg) determined with respect to the coherence between the variability in systolic blood pressure (SBP) and inter-beat intervals (IBI) or heart rate (HR) was tested. SBP and IBI were recorded beat-to-beat for 5 min (Finapres, breathing at 0.33 Hz) in 116 subjects (aged 19-24 years) sitting at rest three times in periods of one week. BRS and BRSf was determined by a cross-spectral method in a frequency range of 0.067-0.133 Hz. Eight indices were evaluated: $BRS_{0.1Hz}$/$BRSf_{0.1Hz}$ - the value at a frequency of 0.1 Hz; BRS_{COHmax}/$BRSf_{COHmax}$ - the value at maximum coherence; BRS_{Wcoh}/$BRSf_{Wcoh}$ - weighted value with respect to coherence values in the whole frequency range; BRS_{WPcoh}/BRS_{WPcoh} - weighted value with respect to coherence for frequencies with coherence above 0.5. All indices revealed a lower intraindividual than interindividual variability ($p<0.001$). The individual mean values of BRS or BRSf correlated ($p<0.001$) with standard deviation of their individual values for all indices. Baroreflex sensitivity is an individual characteristic feature with the highest reproducibility at its low values in spite of its resting variation. Reproducibility is not influenced by modification of the spectral method used.

Key words

Baroreflex sensitivity • Reproducibility • Interindividual variability

Baroreflex sensitivity (BRS, ms/mmHg) shows large interindividual differences. It ranges between 3 and 30 ms/mmHg in healthy adults. BRS varies in time even at rest (Honzíková *et al.* 2003). Low BRS was found in hypertension (Gribbin *et al.* 1971, Lábrová *et al.* 2005) and it is a risk factor in patients after myocardial infarction (La Rovere *et al.* 1998, Honzíková *et al.* 2000). BRS is dependent on the mean interbeat interval, whereas BRSf (mHz/mmHg) is less dependent on mean IBI (Al-Kubati *et al.* 1997). The observed values of BRS also depend on the method of their evaluation (Persson *et al.* 2001).

The aim of the present study was to test the reproducibility of BRS and BRSf in young healthy individuals by the spectral technique.

Systolic blood pressure (SBP) and inter-beat intervals (IBI), and instantaneous values of heart rate (HR), respectively, were recorded beat-to-beat (Finapres) in 116 healthy volunteers (34 men, 82 women) aged 19-24 years, body mass index 21.7±2.3 kg/m^2 (range 15.7-31.1 kg/m^2) after 15 min of rest. The 5-min recordings were taken in the sitting position at rest during metronome-controlled breathing (20 breaths/min) three

times in periods of one week, at the same daytime. The study was approved by the Ethics Committee.

Baroreflex sensitivity was determined by a cross-spectral method (Honzíková *et. al.* 1992). The values of the gain factor of the transfer function among variations in SBP and IBI (or HR) in the frequency range between 0.07-0.13 Hz were taken as measures of baroreflex sensitivity. They were calculated for: the value at 0.1 Hz ($BRS_{0.1Hz,}$ $BRSf_{0.1Hz}$); the value at maximum coherence ($BRS_{COHmax,}$ $BRSf_{COHmax}$); the weighted value with respect to coherence values in the whole frequency range ($BRS_{Wcoh,}$ $BRSf_{Wcoh}$) or for frequencies with coherence above 0.5 ($BRS_{WPcoh,}$ BRS_{WPcoh}).

The resting mean values of all measurements of eight indices of baroreflex sensitivity and IBI of all subjects are summarized in Table 1. In each subject, the BRS and BRSf values were different in three consecutive measurements. These differences were small at low values of BRS and BRSf, and also of IBI, and they increased with increasing mean individual values of these parameters; this effect was the greatest for BRS indices (Table 1, Fig. 1). The differences between intraindividual variability for three measurements in each subject were significantly lower compared to interindividual variability for all indices of baroreflex sensitivity and for IBI as well (Table 1).

Our examinations of spontaneous resting baroreflex sensitivity repeatedly performed in each subject have shown that it is an individually characteristic feature despite its spontaneous fluctuation. All indices of BRS and BRSf determination used in our study revealed a significantly lower intraindividual variability than the interindividual one. This result is not substantially influenced by modifying the spectral method of its determination. Surprisingly, the resting mean IBI representing a tonic autonomous control of heart rate was

Table 1. Mean values and standard deviations of all measurements of baroreflex sensitivity and IBI, comparison of their interindividual and intraindividual variability, and correlation between mean values of three measurements and their standard deviations

Index	$BRS_{0.1Hz}$	BRS_{COHmax}	BRS_{Wcoh}	BRS_{WPcoh}	$BRSf_{0,1Hz}$	$BRSf_{COHmax}$	$BRSf_{Wcoh}$	$BRSf_{WPcoh}$	IBI
Mean	8.56	9.58	7.82	8.47	12.19	13.61	11.13	11.99	852.09
±SD	5.21	5.22	4.02	4.28	6.73	6.77	5.20	5.40	139.45
F	4.44***	4.00***	4.14***	4.07***	4.07***	3.40***	3.91***	3.51***	11.00***
R	0.56***	0.59***	0.49***	0.53***	0.45***	0.46***	0.44***	0.44***	0.46***

Means ± standard deviation (S.D.): BRS, baroreflex sensitivity in ms/mmHg; BRSf, baroreflex sensitivity in mHz/mmHg; $BRS_{0.1Hz,}$ $BRSf_{0.1Hz}$, the value at a frequency of 0.1 Hz; $BRS_{COHmax,}$ $BRSf_{COHmax}$, the value at maximum coherence in the frequency range of 0.067 – 0.133 Hz; $BRS_{Wcoh,}$ $BRSf_{Wcoh}$, weighted value with respect to coherence values in the same frequency range; $BRS_{WPcoh,}$ $BRSf_{WPcoh}$, weighted value with respect to coherence for frequencies with coherence above 0.5; IBI, inter-beat interval; R, Pearson's correlation coefficient (correlation between mean values of three measurements and their S.D.; F-coefficient, ANOVA test (significance of the difference between interindividual and intraindividual variability); *** $p<0.001$

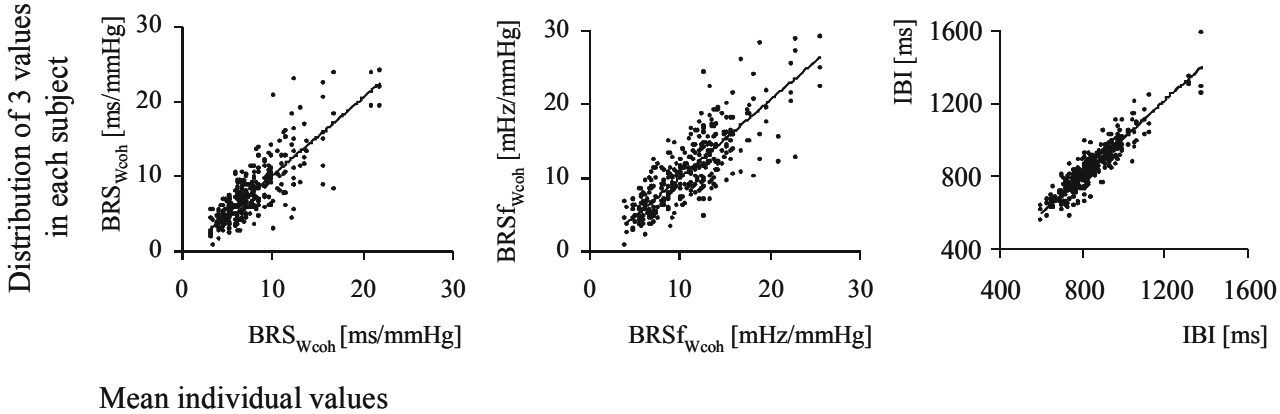

Fig. 1. The relationship between mean values of BRS (left), BRSf (middle), and IBI (right) from three measurements in each subject and the distribution of the three values in each subject (as examples, indices BRS_{Wcoh}, $BRSf_{Wcoh}$ are shown). For abbreviations see in Table 1.

better reproducible than baroreflex sensitivity. We suggest that the high reproducibility of mean IBI potentiates the reproducibility of baroreflex sensitivity measured by the BRS index, which is an index dependent on the mean IBI. The reproducibility of BRS or BRSf values is the best at their low absolute values (Honzíková *et al.* 2004). On the other hand, an increase in the differences of three individual values with an increasing mean value of baroreflex sensitivity in a particular subject may reflect greater dynamics of circulatory regulation resulting from the state of central gain reacting on short-time inner and outer stimuli.

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Reprint requests

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