Synthetic assessment of cardiac autonomic modulation and Baevsky stress index in patients with synucleinopathies

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Funding Acknowledgements: None.

Background: The Baevsky Stress Index (BSTRi), calculated from Heart Rate Variability (HRV) data, has been proposed for quantitative assessment of physiological stress, with higher scores indicating higher levels of physical and/or psychological stress [1]. Cardiac autonomic modulation can be synthetically quantified by calculating the parasympathetic (PNSi) and the sympathetic (SNSi) indexes. The values of the BSTRi, SNSi, and PNSi in patients with synucleinopathies of different prognoses have not been reported yet.

Purpose: To quantify, in patients with Parkinson's disease (PD) and Multisystem Atrophy (MSA), the BSTRi, its correlation with the PNSi and the SNSi indexes, and their potential value for a synthetic assessment of cardiac autonomic modulation and early differential diagnosis between PD and MSA.

Methods: Holter ECG data of 66 patients with Parkinsonian syndromes were retrospectively analyzed after 10 years of follow-up. Out of them, 34 patients with a certain diagnosis of PD (17) and MSA (17) were selected for this study. HRV was analyzed with the Kubios software (version 4.0), providing automatic calculation of the BSTRi, PNSi, and SNSi [2], as well as of time domain (TD), frequency domain (FD), nonlinear (NL), and time-varying (TV) HRV parameters. HRV was calculated from selected short-term intervals (of 5 minutes), during daily activity (ACT5'), and non-REM sleep (NREM5'), and from 24-hours Holter recordings. Patients' HRV findings were compared with those of 51 age-matched healthy subjects (HS).

Results: An example of individual automatic graphic summary is shown in Figure 1. Both short-term and 24-hour BSTRi and SNSi values were significantly ($p < 0.05$) higher in PD and MSA compared to those of HS, in all investigated conditions. Short-term PNSi was significantly higher in HS than in PD in all conditions, but only during NREM5' in MSA patients (Table 1). No significant difference was found between the indexes of PD and MSA patients. As in HS (R=92), BSTRi was positively correlated with the SNSi in MSA (average R= 0.83 and 0.89 during ACT5' and NREM5', respectively), but less evident in PD (R=0.67). The inverse correlation between PNSi and SNSi (R=0.75 in HS) was lost in both MSA and PD.

Conclusions: Higher values of BSTRi in PD and MSA compared to HS suggest that patients with synucleinopathies do experience higher levels of psychophysiological stress, which may affect their quality of life negatively. However, since no significant difference was found in this study between BSTRi values of PD and MSA patients, BSTRi seems at present unreliable for early differentiation between the two diseases. Telematic assessment of BSTRi, SNSi, and PNSi could be useful for remote monitoring of PD and MSA patients' psychophysiological stress, to provide timely intervention and adaptive treatment.

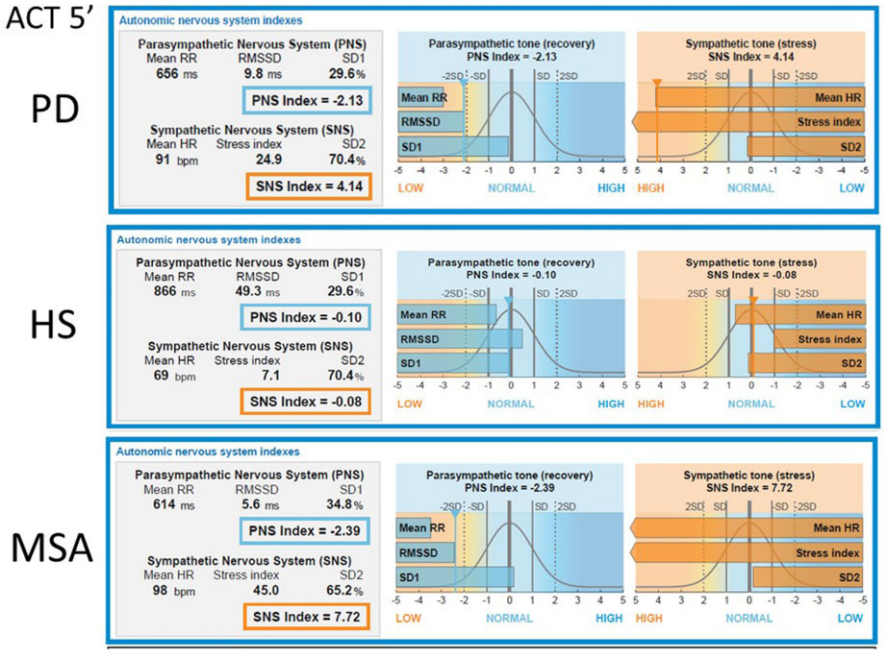

Fig.1 Example of graphic summary (ACT5')

Table 1

	Parkinson Disease							Healthy Subjects					
	ACT 5'		NREM 5'		24 hours			ACT 5'		NREM 5'		24 hours	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*		*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
PNS index	**-1.8**	*0.7*	**-0.6**	*0.6*	**-1.4**	*0.7*	#	**-1.4**	*0.9*	**0.1**	*0.9*	**-0.9**	*0.7*
SNS index	**4.2**	*1.4*	**1.9**	*1.0*	**1.6**	*0.9*	#	**2.1**	*1.8*	**0.5**	*1.2*	**0.5**	*0.9*
Stress index	**28.0**	*6.5*	**22.1**	*6.4*	**14.6**	*2.5*	#	**14.2**	*6.1*	**14.2**	*5.0*	**8.1**	*2.2*

ns

	MultiSystem Atrophy							Healthy Subjects					
	ACT 5'		NREM 5' #		24 hours			ACT 5'		NREM 5' #		24 hours	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*		*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
PNS index	**-1.4**	*0.7*	**-0.5**	*0.6*	**-1,1**	*0.5*	*ns*	**-1.4**	*0.9*	**0.1**	*0.9*	**-0.9**	*0.7*
SNS index	**4.0**	*1.9*	**2.3**	*1.6*	**1.5**	*0.9*	#	**2.1**	*1.8*	**0.5**	*1.2*	**0.5**	*0.9*
Stress index	**29.9**	*8.4*	**25.0**	*7.7*	**16.0**	*3.3*	#	**14.2**	*6.1*	**14.2**	*5.0*	**8.1**	*2.2*

ACT: daily activity NREM: NREM sleep # *p<0.05*