Skeletal Muscle Pump Impairment in Parkinson's Disease: Preliminary Results

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Objective

The purpose of this study is to investigate if impairments in leg muscle contraction affect blood pressure (BP) regulation in patients with Parkinson's disease (PD).

Methods

Simultaneous BP, electrocardiogram, and bilateral electromyogram (EMG) of the tibialis anterior (TA), lateral and medial gastrocnemius (LG, MG), and soleus (SOL) were recorded from 16 patients (age: 64 ± 5 years) with PD and 12 (age: 68 ± 8 years) age-similar healthy controls in supine (5 minutes), head-up tilt test (15 minutes), and standing positions (5 minutes). Convergent Cross Mapping (CCM) was used to examine the causal relationship of the muscle-pump baroreflex (SBP→EMG: systolic blood pressure producing lower leg muscle activity and the skeletal muscle-pump (EMG→SBP: effect of muscle activity on systolic blood pressure).

Results

Preliminary results showed that PD participants have less effective lower leg skeletal muscle-pump (EMG → SBP) compared to the control group (0.89 ± 0.07 vs $0.94 \pm 0.04, p = 0.05$) while no difference was found in the muscle-pump baroreflex (SBP → EMG). Muscle-pump (EMG → SBP) causality was lower for all muscles in PD patients compared to control group (MG: 0.88 ± 0.08 vs $0.94 \pm 0.04, p = 0.02$; LG: 0.89 ± 0.08 vs $0.93 \pm 0.05, p = 0.05$; TA: 0.89 ± 0.09 vs $0.95 \pm 0.04, p = 0.05$; SOL: 0.89 ± 0.07 vs $0.94 \pm 0.04, p = 0.03$).

Conclusions

Our data suggests that PD patients show reduced causal effect of skeletal muscle-pump on blood pressure. The obtained results also highlight the impairment of the ability of muscle-pump to effectively control blood pressure in PD patients. The findings of this study can assist in the development of an effective system for monitoring orthostatic tolerance via muscle-pump to prevent syncope and falls in PD.