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Transcutaneous Vagus Nerve Stimulation (TVNS) Decreases Sympathetic Nerve Activity in Older Healthy Human Subjects

Aaron Murray, University of Leeds
Jennifer Clancy, University of Glasgow
Susan Deuchars, University of Leeds
Jim Deuchars, University of Leeds

Ageing is associated with autonomic dysfunction and increased risk of chronic cardiovascular disease. The aim of the present study is to assess the effects of a non-invasive method of vagus nerve stimulation, transcutaneous vagus nerve stimulation (tVNS) on autonomic activity in older healthy human subjects aged >60 years.

tVNS was applied to the tragus of both ears in 18 subjects (F=12, M=6). Subjects received either 15 min active tVNS or sham stimulation at two visits while heart rate, blood pressure and respiration were monitored. Heart rate variability was derived from power spectral analysis of beat-to-beat oscillations in heart rate. The LF/HF ratio was calculated using low frequency power and high frequency power. Single-unit muscle sympathetic nerve activity (MSNA) was recorded using microneurography.

12 subjects (M=6) had a significant decrease in LF/HF ratio during active tVNS (1.99 ± 0.24 to 1.25 ± 0.14 ; $p = 0.01$). The remaining subjects (F=6) did not experience any changes in LF/HF. Male subjects had a higher baseline LF/HF ($M= 2.00 \pm 0.16$, $F= 1.47 \pm 0.31$; $p = 0.01$). Low frequency power continued to decrease after active tVNS, with no change in high frequency power. No changes in LF/HF were observed as a result of sham stimulation. Microneurography in 5 subjects detected a decrease in single-unit MSNA frequency and incidence during active tVNS ($Z=-2.02$; $p=0.04$).

These results indicate that tVNS reduces MSNA and shifts cardiac autonomic control toward parasympathetic predominance in older adults. Further studies are needed to determine the long-term autonomic effects of tVNS in older subjects.