We conclude that acute baroreceptor stimulation through electrical carotid sinus stimulation does not significantly change muscular glucose delivery and insulin sensitivity in patients with resistant arterial hypertension.

May M, Ahrens J, Menne J, Haller H, Beige J, Eckert S, Jordan J, Engeli S. Limited acute influences of electrical baroreceptor activation on insulin sensitivity and glucose delivery: a randomized, double-blind, crossover clinical study. Diabetes 2014;63:2833–7.

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17.2
Group III/IV muscle afferents impair limb blood flow in patients with chronic heart failure

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Background/Aim: To better understand the hemodynamic and autonomic reflex abnormalities in patients with heart failure (HF), we investigated the influence of group III/IV muscle afferents on the cardiovascular response to rhythmic exercise in this population. Methods: Nine patients with HF (NYHA class-II, mean left ventricular ejection-fraction: 27 ± 3%) performed single leg knee-extensor exercise (25/50/80% of peak workload) under both control conditions and with lumbar intrathecal fentanyl impairing μ-opioid receptor-sensitive muscle afferents. Cardiac output (Q) and femoral blood flow (QL) were determined, and arterial and venous blood samples were collected at each workload. Exercise-induced fatigue was estimated via pre- to post-exercise changes in quadriceps maximal voluntary contraction (MVC). Results: There were no hemodynamic differences between conditions at rest. During exercise, Q was 8-13% lower with Fentanyl blockade, secondary to a 13% reduction in stroke volume and a 2-5% reduction in heart rate ($p<0.05$). A ~20% lower norepinephrine spillover during exercise with Fentanyl ($p<0.05$) revealed an attenuated sympathetic outflow that likely contributed to a 25% increase in leg vascular conductance ($p<0.05$). As a result of this attenuated sympatho-excitation, despite a 4% reduction in blood pressure, QL and therefore oxygen delivery was 10-14% higher and fatigue development was subsequently attenuated by 30% with Fentanyl-blockade ($p<0.05$). Conclusions: Although group III/IV muscle afferent feedback plays a critical role in the central hemodynamic response to exercise in patients with HF, it also appears that these sensory neurons cause excessive sympatho-excitation which impairs QL and likely contributes to exercise intolerance in this population.

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17.3
Autonomic stimulation for the treatment of cardiovascular disease

Stephen Ruble

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Abstracts Selected for Presentation

17.4
Side effects limit acute efficacy of unilateral unipolar electrical carotid sinus stimulation in patients with treatment resistant arterial hypertension

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Electrical carotid sinus stimulation is a treatment modality in resistant arterial hypertension. The first generation device (Rheos™) relying on bilateral placement of bipolar electrodes acutely reduced muscle sympathetic nerve activity (MSNA) and blood pressure (BP) but is no longer available. The second-generation device (Neo™) utilizes a small unilateral unipolar disk electrode to reduce invasiveness while saving battery life. We tested acute effects of the latter on BP and MSNA. We studied 18 patients (9 women, 53 ± 11 years, 34 ± 5 kg/m^2) with refractory hypertension on stable medication who had been implanted with the second-generation device. We recorded BP (oscillometry), heart rate (HR, ECG), and MSNA (microneurography) to assess acute responses to electrical stimulation. Without stimulation, BP was 165 ± 31/91 ± 18 mmHg, HR was 75 ± 17 bpm, and MSNA was 48 ± 14 bursts/min. Acute stimulation with intensities producing side effects that were tolerable in the short term elicited variable changes in systolic BP (SBP: -16.9 ± 15.0 mmHg, range: 0.0 to −40.8 mmHg, $p = 0.002$), HR (-3.6 ± 3.6 bpm, $p = 0.004$), and MSNA (-1.9 ± 5.3 bursts/min, $p = 0.194$). Stimulation intensities had to be lowered in 12 patients to avoid side effects at the expense of attenuated efficacy (SBP: -6.3 ± 7.0 mmHg, range: +2.8 to -14.5 mmHg, $p = 0.028$; HR: -1.5 ± 2.3 bpm, $p = 0.078$; comparison against responses with side effects). Reductions in diastolic BP and MSNA (total activity) tended to be correlated ($r^2 = 0.202$, $p = 0.093$). In our patient cohort few showed satisfactory responses to electrical stimulation in the absence of side effects. The unilateral unipolar electrode design, which has never been tested in a controlled clinical trial, should be scrutinized.

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17.5
Decreased endogenous insulin production improves whole-body insulin sensitivity: is this a sympathetically mediated effect?

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Insulin resistance is a core pathological feature of type 2 diabetes which runs with hyperinsulinemia and with sympathetic overactivity. Herein, we studied the effect of pharmacological blockade of insulin production on whole-body insulin sensitivity, investigating if this