Characterization of the latency and determinism of sympathetic arm of the baroreflex in healthy subjects and amyotrophic lateral sclerosis patients

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In humans, muscle sympathetic nerve activity (MSNA) recordings at the peroneal nerve exhibit a stable temporal relationship between baroreceptor engagement and MSNA burst occurrence with sympathetic baroreflex (sBR) latencies ranging from 900 to 1600 ms. However, modifications of the sBR latency and determinism are not sufficiently elucidated, especially in response to a sBR challenge.

We propose a method to assess sBR latency and determinism by monitoring post-stimulus time distribution (PST) of the time elapsed between R-wave, detected on the ECG, and MSNA burst occurrence. The mode of the PST (if significantly present) in the range of plausible physiological values was taken as an estimate of the sBR latency. We built a binary series coding the appearance/non-appearance of the MSNA burst associated to the R-wave. The level of sBR determinism was computed by comparing the normalized corrected conditional entropy (NCCE) over the original binary series to the NCCE computed over a surrogate series obtained via random shuffling of the original binary digits. The approach was applied to 10 healthy subjects and 5 amyotrophic lateral sclerosis (ALS) patients at rest in supine condition (REST) and during head-up tilt (TILT).

In the healthy population, NCCE was found significantly lower in surrogates than in the original series (0.826±0.069 vs 0.877±0.053, $p<0.001$). The PST distribution had a clear peak centered at 1198±35 ms and 1212±40 ms at REST and during TILT respectively. Conversely, ALS patients did not show a significant separation between original and surrogates series and a clear peak in the PST distribution.

Our findings indicate that in healthy individuals, there is a certain degree of determinism in the appearance of MSNA bursts with highly repeatable sBR latencies, while these features are lost in ALS patients.