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Opinion Article

The Correlation between Heart Rate Variability and Stroke Outcomes

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DESCRIPTION

Increased recurrent stroke, functional disability, and mortality in stroke patients were all strongly correlated with ANS dysfunction. Heart Rate Variability (HRV) is a sensitive indicator of ANS function that was developed to quantify variance in heartbeat intervals. Previous research indicated a strong relationship between HRV and neurological dysfunction, atherosclerosis, and stroke. HRV indicators were typically utilized to reflect how the ANS handled the activity of neurophysiological pathways to the inflammatory process. Converging lines of evidence revealed that the ANS may regulate the inflammatory reflex. According to certain research, asymptomatic or inflammatory flares may be preceded by large changes in HRV measurements, and systematic inflammation has been linked to a higher risk of stroke recurrence. It was unclear, nevertheless, whether the relationship between HRV and stroke outcome was mediated by inflammatory markers. Researchers discovered that Standard Deviation of NN Intervals (SDNN), a sensitive index of HRV, was inversely correlated with inflammatory markers and stroke outcomes in patients with acute ischemic stroke or Transient Ischemic Attack (TIA) in the prospective national stroke registry. The relationship between SDNN and stroke outcomes was partially mediated by two indicators of chronic inflammation, hs-CRP and IL-6. RMSSD, another HRV metric, on the other hand, was not linked to inflammatory markers or the results of strokes.

Numerous researches have assessed how the autonomic nervous system and stroke are related. According to a prior study, ANS dysfunction was linked to a higher risk of death and stroke recurrence, which is consistent with our findings. Additionally, it was discovered that SDNN was linked to a higher risk of stroke and overall mortality. Lower HRV (measured by time-domain and frequency-domain) was associated with a higher risk of incident stroke, while SDNN and RMSSD were both excellent predictors of stroke risk, according to the atherosclerosis risk in communities study with extended follow-up. A possible explanation

for why SDNN and RMSSD have a positive relationship is that SDNN reflects the excitability of both sympathetic and parasympathetic nerves, and the sympathetic excitation period is longer after ischemic stroke. RMSSD, on the other hand, reflects changes in the parasympathetic nerve, which are transient and variable. The autonomic nervous system's sympathetic and parasympathetic branches continuously interact with the inflammatory response in a variety of clinical settings, according to numerous studies. Inflammation may be a mediator of various diseases, according to the vagal nerve study that showed HRV might predict inflammation-mediated death in individuals with pancreatic cancer. The vagus nerve is crucial for regulating and modulating the inflammatory response, according to a meta-analysis on HRV and inflammation, and there is often a negative correlation between HRV and markers of inflammation.

The results were similar with earlier investigations, such as the Heart and Soul Study, which shown that SDNN, rather than RMSSD, was negatively associated to hs-CRP and IL-6. It is possible that the fact that IL-6 and hs-CRP are indicators of systemic inflammation is the reason why they demonstrated mediation effects in contrast to YKL-40 and LP-PLA2-A. While YKL-40 was an inflammatory biomarker involved in controlling glial activation and neuroinflammation, LP-PLA2 was associated to the plaque inflammation/endothelial dysfunction.

Furthermore, we discovered that whereas hs-CRP and IL-6 mediated the link between HRV and stroke recurrence, IL-6's role was more significant than hs-CRP's. In the IL-1, IL-6, and hs-CRP pathway, the cytokine hs-CRP was regarded as a downstream biomarker, whereas IL-6 was an upstream signaling cytokine that has grown to be a key target for immunological control and thrombosis prevention in atherosclerosis.

A stroke outcome predictor, SDNN, an indication of HRV, has a bad connection with inflammatory markers. Studies shows that the association between HRV and stroke outcomes at one year may be partially mediated by inflammatory markers, particularly IL-6 and hs-CRP.

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