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Resting heart rate variability and cognitive control mechanisms

Studies on Heart Rate Variability (HRV) have considered differential gender effects of parasympathetic (or vagal) control on behavioral performance and on functional brain networks. Nonetheless, the intricate relationships among brain oscillations, resting-state HRV, gender and psychological traits in cognitive control tasks have yet to be fully elucidated. We help bridge this research gap by empirically evaluating the relationship between resting-state HRV and EEG reactions as subjects perform tasks involving visual recognition of linguistic ambiguity in Chinese and English sentences. These tasks impose a strong sense of uncertainty in decision-making. It is known that stress or anxiety increases arousal levels particularly under uncertainty situations. A novelty of our study lies in delineation of distinct EEG oscillatory patterns between high and low HRV young women as compared with men by controlling for anxiety effects. Our results revealed a dependency between resting-state HRV and theta/alpha/beta power in individual women. Low HRV women showed stronger theta/alpha/beta de-synchronization compared with their high HRV counterparts, independent of topographic localization. However, low and high HRV men exhibited comparable theta/alpha/beta activity. Trait anxiety scores affected alpha/beta power in the parieto-occipital regions, whereas men with higher scores and women with lower scores showed stronger alpha/beta de-synchronization. We posit that stress-provoking situations may impose additional effects on oscillatory activity in the frontal and temporal regions, a condition in which the interdependency between brain oscillatory activity and resting-state HRV could interact with cognitive control differently in men and women. In other words, the brain networks involved in cognitive control mechanisms differ between men and women, wherein the mechanisms may partially be influenced by female hormones in stressful language tasks.

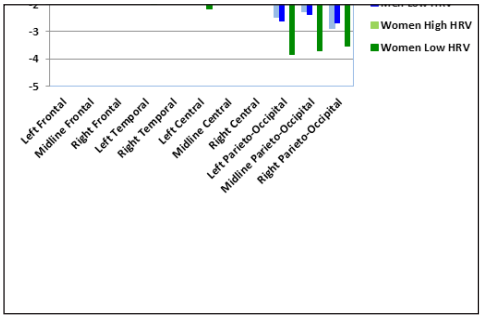

Figure-1: The genetic basis and pathogenesis of the bicuspid aortic valve (BAV) and BAV-associated aortopathy appears to be multifactorial. At the onset of valvulogenesis, a number of mechanisms (e.g. genes, epigenetic factors, fluid forces) may be involved, either alone or in combination, in the pathogenesis.

Recent Publications

1. Liou M, Hsich J F, Evans J, Su I, Nayak S, Lee J D and Savostyanov A N (2018) Resting heart rate variability in young women is a predictor of EEG reactions to linguistic ambiguity in sentences. *Brain Research*; 1701: 1-17.
2. Tsai A, Liou M, Simak M, Cheng P E (2017) On hyperbolic transformations to normality. *Computational Statistics and Data Analysis*; 115: 250-266.

Biography

Michelle Liou has her expertise in medical statistics, functional BOLD responses and EEG oscillatory activity with an emphasis on image/signal processing and scientific inference. She and her lab members initiated the concept of reproducibility for bridging functional MRI techniques and scientific inference and won the 2003 New Perspective in fMRI Research Award from fMRIDC at the Dartmouth College, USA. She also won the Outstanding Research Award from the National Science Council, Taiwan. She is currently working as a Senior Research Fellow at the Institute of Statistical Science, Academia Sinica and Visiting Professor in the Translational Imaging Research Center, Taipei Medical University.

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