­Brain-Heart (Cardiovascular) Interactions in Stress and Anxiety Related Disorders

Implications for Increased Cardiovascular Disease Risk

INTRODUCTION

The mechanism underlying the interaction between cardiovascular and brain health has gained traction over the last several decades, with studies directed at determining how neurobiological phenomenon translate into autonomic imbalances that affect cardiovascular health and events.1-3 Specific stress and anxiety-related disorders have subsequent increased cardiovascular risk.4 Depression and anxiety not only an increased incidence for heart disease but also independently increase cardiovascular mortality.5-9 Similarly post-traumatic stress disorder (PTSD) has an association with incident coronary artery disease (CAD),10,11 which may be mediated through autonomic and inflammatory pathways or explained by co-occurring physical and psychiatric conditions.12,13

This review will highlight the current neurobiological evidence and research on autonomic dysfunction, with a focus on sympathetic overactivity as it relates to anxiety-based disorders, including PTSD and depression. We will also discuss the population-based evidence, including sex-differences, genetic, and epigenetic contributors for poor cardiovascular health outcomes. We will highlight the role of autonomic dysfunction, such as sympathetic overactivity, as well as immunological network activation and inflammation. Finally, preventative and treatment considerations will be discussed, including areas of future research, that range from pharmacologic and behavioral modifications that directly affect relevant neurobiology.

**Sympathetic Nervous System Overactivity in PTSD: Evidence from Human Studies: Jeanie Park**

**Genetics / epidemiology (V. Vaccarino):**

***Inflammation / Anxiety Based Disorders / Cardiovascular implications –Felger / Marvar:* Inflammation and its Effects on Brain, Behavior and CVD risk**

**Neuro-immune Mechanisms of Anxiety-Related Disorders and Increased Risk for CVD**

**Sex Differences in Heart Disease**

REFERENCES

1. Calcagno C, Takx RAP, Ishai A, et al. Relation between resting amygdalar activity and cardiovascular events: a longitudinal and cohort study. *The Lancet.* 2017;389(10071):834-845.

2. Richard Jennings J, Allen B, Gianaros PJ, Thayer JF, Manuck SB. Focusing neurovisceral integration: Cognition, heart rate variability, and cerebral blood flow. *Psychophysiology.* 2015;52(2):214-224.

3. Sgoifo A, Montano N, Esler M, Vaccarino V, Biobehav N, Author R. Stress, behavior and the heart HHS Public Access Author manuscript. *Neurosci Biobehav Rev.* 2017;74:257-259.

4. !!! INVALID CITATION !!! 4-6.

5. Depression and coronary heart disease, Nature Reviews Cardiology(2017).

6. Depression, the autonomic nervous system, and coronary heart disease, Psychosomatic Medicine(2005).

7. State of the art review: Depression, stress, anxiety, and cardiovascular disease, American Journal of Hypertension(2015).

8. Kyrou I, Kollia N, Panagiotakos D, et al. Association of depression and anxiety status with 10-year cardiovascular disease incidence among apparently healthy Greek adults: The ATTICA Study. *Eur J Prev Cardiol.* 2017;24(2):145-152.

9. Pedersen SS, von Kanel R, Tully PJ, Denollet J. Psychosocial perspectives in cardiovascular disease. *Eur J Prev Cardiol.* 2017;24(3\_suppl):108-115.

10. Boscarino JA. A prospective study of PTSD and early-age heart disease mortality among Vietnam veterans: implications for surveillance and prevention. *Psychosom Med.* 2008;70(6):668-676.

11. Vaccarino V, Goldberg J, Rooks C, et al. Post-traumatic stress disorder and incidence of coronary heart disease: a twin study. *J Am Coll Cardiol.* 2013;62(11):970-978.

12. Brudey C, Park J, Wiaderkiewicz J, Kobayashi I, Mellman TA, Marvar PJ. Autonomic and inflammatory consequences of posttraumatic stress disorder and the link to cardiovascular disease. *Am J Physiol Regul Integr Comp Physiol.* 2015;309(4):R315-321.

13. Scherrer JF, Salas J, Cohen BE, et al. Comorbid Conditions Explain the Association Between Posttraumatic Stress Disorder and Incident Cardiovascular Disease. *Journal of the American Heart Association.* 2019;8(4):1-11.