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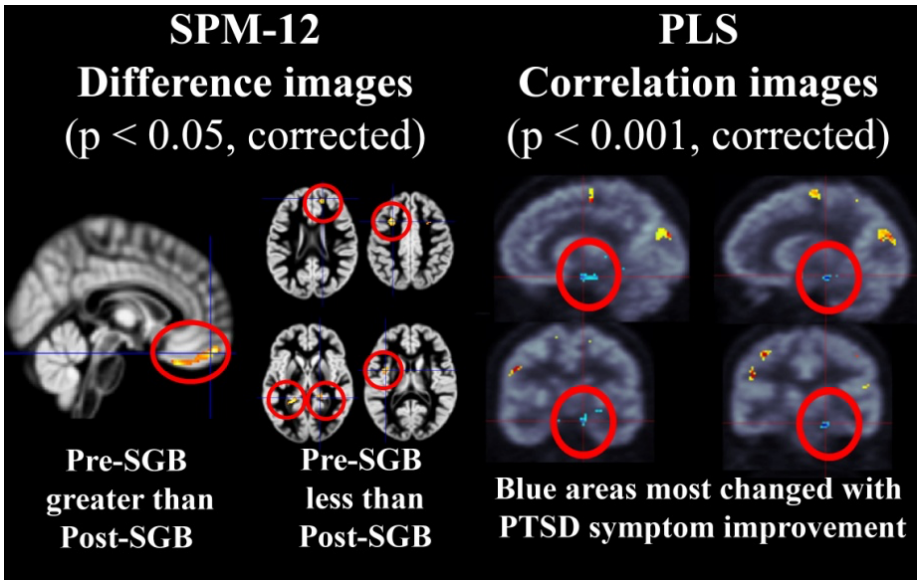
TITLE:

Neuroimaging Suggests that Stellate Ganglion Block Improves Post-Traumatic Stress Disorder (PTSD) Through an Amygdala Mediated Mechanism



AUTHOR(S):

Michael T. Alkire, M.D.[1], Michael Hollifield, M.D.[2], Rostam Khoshsar, M.D.[2], Linda Nguyen, M.P.H.[2], Stephanie R. Alley, M.A.[2], Christopher Reist, M.D.[3].

[1]Anesthesiology, Long Beach VA Healthcare System and Univ of California, Irvine, CA, USA, [2]Long Beach VA Healthcare System, Long Beach, CA, USA, [3]Long Beach VA Healthcare System and Univ of California, Irvine, CA, USA.

ABSTRACT:

INTRODUCTION: Stellate ganglion block (SGB) is a known part of treating chronic pain. Recently, it was found to result in rapid and sustained relief of post-traumatic stress disorder (PTSD) symptoms [1,2]. The neural mechanisms by which this happens remain unknown. We investigated the neurobiology of PTSD by imaging functional brain metabolic activity with positron emission tomography (PET) before and after the SGB procedure.

METHODS: Following IRB approval, informed consent was obtained from five male veterans (mean age 31 ± 4) with chronic combat-related PTSD having prominent hyperarousal symptoms. Subjects underwent two separate fluorodeoxyglucose (FDG) PET brain scans on a GE Discovery 600 PET/CT. The first scan was obtained one week prior to undergoing a single right-sided SGB using 8cc of 2% lidocaine and 0.25% bupivicaine under fluoroscopic guidance. The second scan was obtained one week following the SGB. PTSD symptoms were formally assessed using the Clinician Administered PTSD Scale (CAPS) score (a structured interview) one week before and again one week after the SGB. Preliminary data were analyzed for regional relative brain activity differences using statistical parametric mapping (SPM-12) and functional connectivity changes using partial least squares (PLS).

RESULTS: All subjects tolerated the procedure well. SGB dramatically reduced PTSD symptoms in 3 of 5 (60%) subjects. Overall, the CAPS showed a 47% reduction in PTSD symptom severity at one week following SGB, with a baseline mean (±SD) score of 89 ± 12 (severe PTSD) that was reduced to 48 ± 12 (mild/moderate PTSD) after the block ($P<0.05$, paired t-test). The only brain region that was relatively more active in the pre-SGB scans contrasted with the post-SGB scans was the orbital frontal cortex (see figure). At the same time, the brain regions that were relatively less active included; the left insula, right frontal cortex, left dorsolateral prefrontal cortex and bilateral portions of the posterior hippocampus. Importantly, brain regions that correlated with the individual CAPS scores and their functional improvement following SGB centered on the amygdala and hippocampus, primarily in the right hemisphere.

DISCUSSION: We found SGB had efficacy for significantly reducing PTSD symptoms in a rapid and sustained manner that allowed functional brain activity to be compared in the same subjects when they were suffering with PTSD symptoms versus when their symptoms were greatly diminished. In this small pilot study, the behavioral difference between experiencing and not experiencing severe PTSD symptoms appeared to be correlated primarily with differences in right amygdala and nearby hippocampal functional activity. The right amygdala/hippocampal areas appear to be relatively overactive when PTSD symptoms are prominent. This may be due to the observed differences in orbital frontal cortex activity (or other network effects), a finding that suggests a dysregulation of orbital frontal cortex to amygdala inhibition likely exists when PTSD

symptoms are severe. The study also shows that the SGB effect on PTSD symptoms, even if ultimately proven to be no more than a placebo, still has substantial neural substrates that can be indentified in a relatively small number of brain scans.

REFS: [1] Lipov EG, et al.: Cervical Sympathetic Blockade in a Patient with Posttraumatic Stress Disorder: a Case Report. Ann Clin Psychiatry. 2008;20:227-228.
[2] Alkire MT, et al.: Prolonged Relief of Chronic Extreme PTSD and Depression Symptoms in Veterans Following a Stellate Ganglion Block. ASA abstract A1046, 2014.

SUMMARY:

We found stellate ganglion block had efficacy for significantly reducing PTSD symptoms in a rapid and sustained manner that allowed functional brain glucose metabolic activity to be compared in the same subjects when they were suffering with PTSD symptoms versus when they were not. In this small pilot study, the behavioral difference between having and not having PTSD symptoms appeared to be correlated primarily with differences in right amygdala and nearby hippocampal functional activity changes.