A Novel Application of Stellate Ganglion Block: Preliminary Observations for the Treatment of Post-Traumatic Stress Disorder

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Across the five branches of military service, there is a common thread that binds, namely the honorable imperative to support our national security by maintaining, training, and equipping combat-ready forces. Although implementing their primary directives when called to action is an absolute necessity for securing the freedom and well-being of the general public, the realities of achieving such noble objectives bear many negative consequences for those who sacrifice their health in the process. The epidemic occurrence of the pathological anxiety condition post-traumatic stress disorder (PTSD) among combat-exposed active duty military service members and veterans is a seminal testament to the aftermath of war and the ongoing conflicts of our time.

PTSD is characterized by debilitating symptoms such as intense anxiety, hyperarousal, irritability, intrusive thoughts, and sleep disturbances. The adverse consequences of PTSD are profound, resulting in high rates of suicide, depression, substance use, violence, and an inability to maintain relationships.[1] Approximately 14% to 35% of our 22.8 million U.S. veterans with a history of combat duty suffer from PTSD, a figure that far surpasses the 6.8% prevalence of PTSD among adult Americans.[2] Amid active duty service members, studies have documented PTSD prevalence rates ranging from 10% to 18% following combat deployment.[3] In addition to substantial human capital costs, the economic burden of PTSD is enormous with estimated costs from $4.0 to $6.2 billion over 2 years.[1] The current cost estimates for the treatment of PTSD range from $6,000 to $30,000 per patient.[1]

ALTERNATIVE TREATMENT OPTIONS ARE NEEDED FOR PTSD

Current treatment options for PTSD are limited to pharmacotherapy (e.g., selective serotonin reuptake inhibitors), psychotherapies (e.g., cognitive and exposure modalities), or a combination of the two. These treatments have proven efficacious in some patient populations, but their overall success rates are typically less than 30% among patients with resistant PTSD (e.g., veterans or active duty military personnel with combat exposure).[4] Factors associated with lower rates of treatment success include the inability to cope with the extended therapy time, presence of secondary disorders that adversely impact compliance (e.g., alcoholism), limited access to therapies, and a tendency to dissociate.[1] Thus, there is a pressing need for alternative safe, effective, and rapid treatment options for PTSD.

Recently, a novel application of stellate ganglion block (SGB), one of the most commonly used procedures for pain management of the face and upper extremity, has revealed promising "para-anesthetic effects" (i.e., atypical effects) in three case reports among PTSD patients.[5,6] To further explore the utility of SGB in treating PTSD, we conducted a case series among patients who had failed standard therapies for at least 1 year (i.e., treatment resistant PTSD). Since the stellate ganglion has been demonstrated to have second- and third-order neuron connections with the central nervous system nuclei that modulate the manifestations of PTSD, it seems reasonable to us that SGB may reset the area of the brain responsible for anxiety to its pretrauma state much as sympathetic blocks utilized for sympathetically maintained pain are thought to reset the central nervous system and autonomic nervous system changes with intractable neuropathic pain.

SGB TREATMENT PROCEDURE

Peripheral intravenous access was obtained using universal precautions. Patients were positioned supine on a fluoroscopy table, placed into cervical extension with a shoulder roll, and hemodynamically monitored (e.g., pulse oximetry, electrocardiogram). If the patient elected sedation, 50 μg/cc of fentanyl and 1 mg/cc of midazolam were administered intravenously. The usual dose of fentanyl administered was 100 μg and midazolam was titrated to effect from 1 mg to 6 mg, depending on the patient's requirement.

The right C6 vertebral body was identified with fluoroscopic guidance. The skin and subcutaneous tissue at the site of injection were infiltrated with local anesthetic (i.e., 1% lidocaine). A 22-gauge needle was directed percutaneously to the anterolateral C6 vertebral body at its junction with the right C6 tubercle. After negative aspiration for blood and cerebrospinal fluid, 2 cc of nonionic contrast media

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was injected to visualize dye spread over the perivertebral plane, followed by an incremental administration of 7 cc of 0.5% bupivacaine. The needle was then removed to complete the 5 to 10 minute procedure. Although SGB complications may include a risk of infection, bleeding, seizures, and spinal cord trauma, these potential adverse events are rare[7] and none were encountered by patients in our case series. Moreover, current use of fluoroscopic guidance, digital subtraction angiography, and ultrasound further reduces the potential risk of aberrant needle placement or intravascular injection.

PRELIMINARY PILOT OBSERVATIONS

The medical records of a case series of eight patients with persistent PTSD who consented to receive SGB treatment were reviewed retrospectively at a single private practice setting. A wide range of demographic and clinical data was extracted including PTSD severity, which was measured using the validated 17-item PTSD Checklist, Military Version (PCL-M).[8] PCL-M contains Likert-type scales (ranging from1 = not at all to 5 = extremely) that capture anxiety symptoms related to re-experiencing, avoidance, and hyperarousal. Descriptive statistics were performed along with comparative t tests, with $p < 0.05$ denoting statistical significance.

The majority of the patients were male (88%), white (100%), unmarried (63%), employed (63%), and veterans (63%). The average age across the case series was 43.4 years (SD = 15.5; range 29–66 years). All of the patients had been diagnosed with PTSD for at least 4 years without successful response to standard therapies. Most of the patients (75%) were taking three or more medications to manage their PTSD and related comorbidities (e.g., depression). The average follow-up time was 17.5 days (range 1–59 days) to assess changes in PTSD symptom severity.

Our results revealed that after one SGB treatment, 6 of 8 (75%) patients experienced a substantial decline in PTSD symptom severity (range 47.3%–73.4%). The remaining two patients benefited from a decrease in symptoms, but the results were not clinically meaningful (6% and 12.1%). The mean pre-SGB treatment severity PCL-M score was 67.8 (range 55–79), while the mean post-SGB treatment severity score was 35.3 (range 21–63). Among patients who received only one SGB, statistically significant improvements ($p < 0.05$) in overall PTSD severity were observed in symptoms associated with avoidance (e.g., increased ability to feel and demonstrate affection, reduced self-isolation) and hyperarousal (e.g., improved sleep and concentration, reduced angry outbursts) psychological dimensions (11.2% and 9.2%, respectively). No significant SGB effects were observed specific to PTSD symptoms associated with re-experiencing. Relative to patients who received one SGB injection, the two patients with multiple SGB treatments experienced greater levels of PTSD symptom relief (decreases in severity score of 58.6% and 73.4%). No adverse events or complications of any kind were reported secondary to SGB.

DISCUSSION AND IMPLICATIONS

Our preliminary case series observations support the few existing case reports that have shown SGB to be a hopeful treatment alternative for PTSD. Our findings suggest that SGB produces some form of a "calming effect" that primarily impacts avoidance and hyperarousal dimensions of PTSD. Despite these promising preliminary observations, study limitations leave answers to questions that impact clinical decision-making elusive. For example, it is not clear how long the effects of SGB may last. Moreover, it is not known whether there is a cumulative effect with repeated treatments and what time frame would be optimal for a treatment regimen. Additionally, there is insufficient data to illuminate patient factors that may influence treatment response. Lastly, the definitive mechanism of action for SGB in the treatment of PTSD remains uncertain.

SGB has the potential to provide improved care for PTSD by means of an innovative, minimally invasive medical procedure. As a treatment option for PTSD, SGB deserves further study as it may provide a meaningful adjunct to current psychological treatments and may reduce the need for pharmacological treatments. Current therapies are time-consuming and costly to both patients and our already overburdened health care system. Psychiatric medications can take 2 to 6 months to achieve efficacy and the longer-lasting side effects of medications can have negative impact on treatment compliance. By contrast, SGB requires approximately 10 minutes to administer at an estimated cost of $2,000 for a full treatment course (i.e., two SGB injections) and durable short-term relief of PTSD symptoms occurs within hours after treatment. Hence, SGB has the potential to make a significant, near-term impact on improving the functional capacity of veterans and active duty members of the military. Since SGB and the sympathetic cervical block are commonly used for pain control in many clinics across the United States, the treatment does not require Food and Drug Administration approval. If proven effective in rigorously designed clinical trials, SGB could be quickly duplicated and scaled into practice throughout the country and readily deployed as a model for care within the affected military population.

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REFERENCES

1. Tanielian T, Jaycox LH (editors): Invisible Wounds of War: Psychological and Cognitive Injuries, Their Consequences, and Services to Assist Recovery, Santa Monica, CA, RAND Corporation, 2008.
2. Harvard School of Medicine. National Comorbidity Survey. Available at http://www.hcp.med.harvard.edu/ncs/publications.php; accessed September 5, 2011.

3. Litz BT, Schlenger WE: PTSD in service members and new veterans of the Iraq and Afghanistan wars: a bibliography and critique. PTSD Research Quarterly 2009; 20(1): 1–8.
4. Institute of Medicine: Treatment of Posttraumatic Stress Disorder: An Assessment of Evidence. Washington, D.C., The National Academies Press, 2008.
5. Mulvaney SW, McLean B, de Leeuw J: The use of stellate ganglion block in the treatment of panic/anxiety symptoms with combat-related post-traumatic stress disorder; preliminary results of long-term follow-up: a case series. Pain Pract 2010; 10: 359–65.
6. Lipov EG, Joshi JR, Lipov S, Sanders SE, Siroko MK: Cervical sympathetic blockade in a patient with post-traumatic stress disorder: a case report. Ann Clin Psychiatry 2008; 20: 227–8.
7. Wulf H, Maier C: Complications and side effects of stellate ganglion blockade. Results of a questionnaire survey [Article in German]. Anesthesist 1992; 41: 146–51.
8. Bliese PD, Wright KM, Adler AB, Cabrera O, Castro CA, Hoge CW: Validating the primary care posttraumatic stress disorder screen and the posttraumatic stress disorder checklist with soldiers returning from combat. J Consult Clin Psychol 2008; 76: 272–81.