

## Is Stellate Ganglion Block an Alternative Treatment for Posttraumatic Stress Disorder?

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### Abstract

Stellate Ganglion Block, also known as cervical sympathetic block, is an outpatient procedure which is approved for diagnosing and treating complex pain syndromes affecting multiple locations in the head, neck, face, chest or arms. Although, there are several evidence based and effective pharmacological and psychological treatments that are available for the treatment of posttraumatic stress disorder. Many patients do not respond or do not adhere to these effective treatments due to the chronicity of their illness, the occurrence of adverse effects or the presence of social stigma associated with receiving psychotherapy and psychopharmacological treatments. This article review the definition of posttraumatic stress disorder, and its currently available conventional treatments, then summarizes the historical background, the rational and the possible risks associated with the use of Stellate Ganglion Block as a potential alternative treatment modality for posttraumatic stress disorder. There is still an urgent need to undergo rigorous well-designed randomized double-blind and placebo-controlled research clinical trials to confirm the utility of Stellate Ganglion Block as an alternative evidence-based treatment modality for posttraumatic stress disorder.

**Keywords:** *Posttraumatic Stress Disorder; Stellate Ganglion Block; Psychotherapy; Psychopharmacology; Treatment; Guidelines*

### Introduction

Posttraumatic stress disorder (PTSD) is a psychiatric condition that develops following a traumatic event that has been experienced, threatened with, or witnessed toward loved ones or others. In 2013, PTSD was re-classified in the American Psychiatric Association Diagnostic and Statistical Manual (DSM-5) under the new class of "trauma and stressor related disorder" [1]. It is characterized by recurrent and intrusive distressing recollections of the traumatic event, with intense psychological or physiological distress at exposure to cues that resemble the traumatic event, avoidance of stimuli associated with the trauma, or inability to recall important aspects of the trauma. Individuals with PTSD often experience a cluster of additional symptoms including loss of interest, estrangement from others, sleep disturbances, nightmares, irritability, difficulty concentrating, hypervigilance, exaggerated startle responses, aggressive behaviors, shame and guilt, substance abuse and some patients develop dissociative flashback episodes [1,2]. The symptoms must last more than a month and be severe enough to interfere with relationships or work to be considered PTSD. The symptoms of PTSD usually begin early, within 3 months of the traumatic incident, but sometimes they begin years afterward and would be described as delayed onset PTSD. The course of the illness varies. Some patients recover within 6 months, while other develop ongoing and chronic PTSD. Chronic PTSD is associated with long-term interpersonal, vocational, societal and financial difficulties [3]. The lifetime prevalence of PTSD ranges from 6.1 to 9.2

percent in national samples of the general adult population in the United States [4]. Higher rates of PTSD have been found in population subgroups in the United States compared with the general population, including Native Americans living on reservations and refugees from countries where traumatic stress was endemic [5]. Among Veterans seen in the Veterans Health Care Systems, PTSD is the third most common psychiatric diagnosis that is debilitating, leading to a decline in quality of life and resulting into significant medical, mental health, interpersonal, and social impairment [6]. The conventional treatment of PTSD is complex and would require individualized and an interdisciplinary approach that combine pharmacological, psychological, social and spiritual Interventions [7]. However, many clinical challenges and burdens have been identified in the context of their effectiveness and implementation [8]. For individuals who do not respond or reject PTSD conventional treatment approach, stellate ganglion block (SGB) has been offered by some clinicians as an adjunctive or alternative promising treatment modality.

### Recommended conventional PTSD treatments

The mainstay of treatment for PTSD include psychotherapy, pharmacotherapy, or their combination. Several psychotherapies have also shown effectiveness in the treatment of PTSD including cognitive behavioral therapy (CBT), cognitive processing therapy (CPT), prolonged exposure (PE), stress inoculation training (SIT), trauma-focused psychotherapy, virtual reality re-exposure therapy and eye movement desensitization and reprocessing (EMDR) therapy [9]. These psychotherapies include several components such as narration, cognitive restructuring, *in vivo* exposure, stress inoculation skills and psychoeducation [10].

The first-line medications for PTSD are the selective serotonin reuptake inhibitors (SSRIs) class of antidepressants. Among the SSRIs sertraline and paroxetine are currently Food and Drug Administration (FDA) approved for PTSD treatment. However, many patients do not have an adequate response to these two medications and are treated with other SSRIs antidepressants such as, fluoxetine, fluvoxamine, citalopram, or escitalopram. Although, the SSRIs have better overall safety and tolerability than older antidepressants, many patients do not respond to the SSRIs and some discontinue treatment due their adverse effects, especially sexual dysfunction, weight gain, and sleep disturbance. The Serotonin-norepinephrine reuptake inhibitors (SNRIs) such as venlafaxine, desvenlafaxine and duloxetine are considered the second line of PTSD pharmacological treatment. Different classes of psychotropic medication are also often utilized to achieve a therapeutic response in patients who have not responded to the SSRIs or SNRIs. The sympathetic blockers or anti-adrenergic agents such as prazosin are also used as adjunctive treatments for nightmares, and clonidine for anxiety and sleep issues. Other antidepressants, mood stabilizers, anxiolytics and atypical antipsychotics have also been used to manage symptoms related to sleep disturbances, agitation, aggression, mood instability, and psychotic symptoms [2,11]. The heterogeneity of symptom clusters in PTSD as well as the complex co-occurrence of other psychiatric comorbidities such as mood disorders, especially major depression, anxiety disorders including panic disorder, agoraphobia, and generalized anxiety disorder, obsessive compulsive disorder and substance use disorders often lead clinicians to the use of combination of medications and especially for PTSD treatment resistant patients [8]. Despite these available treatments, many individuals continue to exhibit ongoing PTSD symptoms and discontinue treatment due to the slow onset of action of pharmacological treatment, or its lack of effectiveness and the burden of side effects in addition to the required prolonged involvement in psychotherapies [10]. The overall success of conventional PTSD treatments is variable, with rates of remission generally ranging from 30% to 40% [9]. Veterans with PTSD have identified several barriers to seeking and maintaining treatment adherence such as readiness for treatment, social stigma, and logistical obstacles [12]. As a result, clinicians and patients alike have been searching for alternative treatments that are faster in showing effectiveness with minimal side effects that would further contribute to improving the health and well-being of individuals with PTSD. Over the past few decades, several research studies and clinical trials confirmed the potential therapeutic value of SGB as an alternative viable intervention for patients who reject or have not responded or progressed while receiving the currently available conventional PTSD treatment modalities [13].

### Historical background

Over the past several decades and since 1925, SGB has been used successfully to treat a variety of sympathetically modulated conditions ranging from chronic regional pain syndrome (CRPS) to postherpetic neuralgia [13]. Interest in SGB increased considerably over the

past decade as it was reported to offer rapid relief of PTSD symptoms [13,14]. In a case report published in 1990, SGB was used for the treatment of upper extremity pain and subsequently leading due to alleviating physical and psychological distress after receiving several SGB injections [15]. A case report was also published describing a patient with schizophrenic who received SGB for pain symptoms and experienced a decrease in hallucinations [16]. In a case report a patient who did not respond to pharmacological and psychotherapeutic interventions experienced 32 days remission of PTSD after receiving SGB [17]. Other reports also suggested that SGB might alleviate PTSD symptoms that are related to combat traumatic experiences [18]. Reports on safety and patient acceptability on the use of SGB in combat related PTSD treatment were also added to the literature [19]. Military service members diagnosed with PTSD were also evaluated for the potential effects of SGB on measures of neurocognitive performance, including memory and reaction time, and did not develop any impairment in these functional categories with treatment [20]. Formal systematic review of previous case reports and case series also documented the beneficial effects of the use of SGB for treatment of PTSD [14,21]. A large multicenter, randomized clinical trial also demonstrated twice the effect of SGB over a sham procedure [22]. Wider use of SGB as a PTSD treatment has been implemented in several institutions such as Walter Reed Hospital, San Diego Naval Hospital, Tripler Hospital, and the Long Beach California Veterans Hospital [13,23].

### The rationale of using SGB in PTSD

For many PTSD patients, hyperarousal is their predominant disabling symptom, and has been attributed to a “dysfunctional sympathetic tone” where somatic responses to stimuli are magnified [20]. Exaggerated hyperarousal symptoms have also been identified as independent predictors of treatment resistance to the currently recommended conventional treatments [24]. Many research studies suggest that the continuous activation of the sympathetic nervous system in PTSD could lead to prolonged arousal, hypervigilance, and aggravates other PTSD related symptoms such as anxiety, mood fluctuation and cognitive difficulties. Furthermore, in individuals with PTSD the amygdala which is the fear center of the brain could be constantly activated thus resulting in sympathetic nervous system over stimulation. Although SGB exact mechanism of action in relieving PTSD symptoms is still unknown. One proposed mechanism of action is that SGB might inhibit connections between the peripheral sympathetic nerve system and regions of the cerebral cortex thought to be abnormally activated in PTSD due to an overstimulated amygdala. Positron emission tomography scans (PET) taken one week before and after undergoing right-sided SGB found that the right amygdala and hippocampal areas were relatively overactive when PTSD symptoms were more prominent [23]. Another proposed mechanism is that SGB suppresses the nerve growth factor (NGF) which has been associated with increased levels of noradrenaline in patients with PTSD [25]. The stellate ganglion is a sympathetic ganglion formed by the fusion of the inferior cervical ganglion and the first thoracic ganglion. Sometimes, the second and the third thoracic ganglia are included in this fusion. Stellate ganglion is relatively big compared to much smaller thoracic, lumbar and sacral ganglia and it is polygonal in shape. Stellate ganglion is located at the level of C7, anterior to the transverse process of C7 and the neck of the first rib, superior to the cervical pleura and just below the subclavian artery. It is superiorly covered by the prevertebral lamina of the cervical fascia and anteriorly in relation with the carotid artery, subclavian artery and the beginning of vertebral artery which sometimes leaves a groove at the apex of this ganglion. The stellate ganglion has been described as the command center from where sympathetic impulses reach the head, neck, arms and the chest region and by blocking the stellate ganglion it is assumed that the sympathetic nervous system is blocked thus leading to the prevention of the PTSD symptoms of hyperarousal.

### How is SGB performed?

SGB is considered a moderately difficult outpatient procedure that need to be performed by anesthesiologists or interventional pain management physicians that specialize in treating various disorders including complex regional pain syndrome, hot flashes, migraines, facial pain and upper extremity pain. A nursing staff is also present during the procedure to help achieve the optimal positioning during the injection. Prior to performing the SGB, a local anesthetic may be injected into the neck region near the larynx. When the local anesthetic takes effect and the muscles lose some of their pain sensitivity, a second injection with a long-acting local anesthetic is typically injected at the C6 or C7 vertebral levels, with an injection into C6 being considered as the “safer” approach. Ropivacaine or bupivacaine, 7 cc of 0.5% solution, are the most common anesthetic types and dosages used in SGB [26,27]. To assure the accuracy of the ideal injection

site and avoid potential serious adverse effects of inaccurate needle placement to the anatomy surrounding the stellate ganglion, use of image-guidance techniques such as ultrasound, fluoroscopy, or computed tomography are recommended to help visualize the injection area. Several studies have shown that a right sided SGB results in significant improvement in PTSD symptoms. The SGB takes less than 15 minutes to perform. While the effects of anesthesia last only for a few hours, the long-term effects of this procedure may last for many weeks or even longer in some cases. Some individuals may need repeated SGB at spaced time intervals of weeks and months to experience its full beneficial effects in alleviating PTSD persistent symptoms.

### Proposed benefits of SGB for PTSD

It has been suggested that SGB may play a role in removing some of the social stigma associated with receiving psychotherapy and psychopharmacological treatments by offering a medical procedure for the management of PTSD. It is considered a fast-acting treatment alternative with noticeable improvements reported within minutes to days compared to the slow-onset of medications and long-term commitment required by most psychotherapies. It may also improve overall adherence with comprehensive PTSD treatment interventions since it is administered in one setting rather than ongoing daily or weekly participation.

### The risks and side effects of SGB

The risk of severe complications due SGB is low. Slight bruising, swelling and soreness may occur at the injection site, however these side-effects are generally mild. More serious consequences such as infection, nerve injury or bleeding may occur, but are uncommon. The performance of SGB requires continuous vital sign monitoring and the availability of resuscitative equipment to assess and respond to abrupt changes in respiratory and cardiac conditions that may occur as a result of unintentional intravascular injections. Identification of a successful SGB is made by diagnosing temporary Horner's syndrome occurring within 15 minutes of the procedure which is recognized by the presence of a constricted pupil, weak and droopy eyelid, decreased sweating, and potential inset eyeball [28]. In addition, there are several short-term side effects from the procedure that may last only for a few hours until the effects of the anesthetic subside and these may include red eyes, drooping of the eyelids, nasal congestion, hoarseness with breathy, raspy, or strained voice, difficulty with swallowing, sensation of a "lump" in the throat and feelings of warmth or tingling in the arm or hand. There is also a risk of developing convulsions which could occur at the rate of 1.7per1000 [29]. Contraindications for SGB include a history of allergy to anesthetics and due to its possible risks of ocular, cardiac, and circulatory adverse effects, it should be avoided in patients with coagulopathy, those with recent myocardial infarction, or cardiac conduction block and in patients with glaucoma [28,29].

### Guidelines governing SGB for PTSD

The use of SGB for PTSD treatment is not FDA approved, it is considered an "off-label" use and is not yet recognized as an evidence based intervention. Currently available practice guidelines from various clinical settings and professional organizations do not include SGB as an optional treatment for PTSD [30]. The main source of SGB proposed benefits in PTSD treatment are provided by Veterans advocacy groups, internet articles and a slew of network television appearances by pain management anesthesiologists promoting this treatment modality as a safe and effective intervention for PTSD [18]. Areas of concern are related also to the cost of performing SGB, since it will not be covered or reimbursed by health insurance companies when it is used "off-label" for PTSD treatment.

### Summary

The conventional first line treatment of PTSD include psychotherapy, pharmacotherapy, or their combination. Despite these available treatments, many individuals continue to exhibit ongoing PTSD symptoms and discontinue treatment due to the slow onset of action of pharmacological treatment, or its of lack of effectiveness and the burden of medications side effects in addition to the required ongoing time involvement in psychotherapies. As a result, there is an urgent need to explore alternative PTSD treatment options. By its nature SGB seems to offer a potentially alternative effective treatment modality for PTSD due to its medical procedural nature and relative fast onset of action with lesser incidence of adverse effects. Although it seems promising, SGB is not FDA approved or evidence-based treatment

for PTSD. Well-designed randomized double-blind, placebo-controlled research clinical trials are needed to confirm SGB as an alternative evidence-based PTSD treatment modality. Until then, clinicians are behooved to exert prudence and wise clinical judgement prior to recommending SGB as a cure all PTSD treatment intervention.

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### Conflicts of Interest

The materials described in this article are those of the authors and do not reflect the views of the Department of Veterans Affairs or the VA Northern California Health Care System or UC Davis Health, Sacramento, California.

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