Clinical Guidelines for Stellate Ganglion Block to Treat Anxiety Associated With Posttraumatic Stress Disorder

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ABSTRACT

Multiple case series published in the peer-reviewed medical literature have demonstrated the safety and efficacy of right-sided stellate ganglion block (SGB) for the treatment of anxiety symptoms associated with posttraumatic stress disorder (PTSD). As this is a new indication for a well-established procedure, there is relatively little information available to assist clinicians in determining the utility of SGB for their patients. Presented are clinical guidelines to assist the provider with patient selection, patient education, and follow-up. Also described is a technique to perform SGB under ultrasound-guidance. Although additional rigorous clinical research is needed to further investigate SGB for the treatment of anxiety symptoms associated with PTSD, these guidelines can also assist clinical investigators in their participant selection, design, and conduct of future research as it pertains to this important topic.

KEYWORDS: *posttraumatic stress disorder; stellate ganglion block; ultrasound, guided; anxiety; clinical guidelines*

Introduction

Primary dysfunction of the nervous system can result in pain syndromes referred to as neuropathic pain. This type of pain is different from nociceptive pain, which originates from injury to non–nervous system tissue. Neuropathic pain may in part be maintained by the sympathetic branch of the autonomic nervous system as well as the somatic nervous system. Blockade of the sympathetic nervous system can thus prove useful in the treatment of some types of neuropathic pain.[1]

Preganglionic sympathetic nervous system fibers originate in the thoracic and lumbar regions of the spinal cord. Sympathetic nerves exit the spinal cord and come together to form the sympathetic trunk. The sympathetic trunk is a paravertebral structure that extends into the neck to form three cervical ganglia, the most caudad of which is the star-shaped stellate ganglion.

The SGB is an effective method for temporarily blocking sympathetic input to the central autonomic network in the brain, head, face, and arm and thus has potential for treating pain that occurs in the upper extremities and thorax, as well as the face and neck.[1,2] Current indications for SGB include sympathetically maintained pain syndromes such as complex regional pain syndrome as well as other neuropathic pain syndromes such as limb ischemia, herpes zoster, post herpetic neuralgia, post radiation neuritis, and pain from vasospasm including Raynaud's disease and frostbite.[1] Emerging indications for SGB include hot flashes following menopause or breast cancer treatment,[3] as well as anxiety symptoms associated with PTSD.[4–12]

Posttraumatic stress disorder may develop after a person experiences a traumatic event, including sexual assault, combat-related action, or threat of violence or imminent death.[13] Right-sided SGB is a therapeutic modality that can be used to successfully treat anxiety symptoms associated with PTSD, as physiologically SGB can potentially influence both the central autonomic network (including the amygdala, insular cortex, and hypothalamus) as well as the cardiovascular system, which are central systems responsible for anxiety. Presented are clinical guidelines for this procedure, based on a comprehensive review of the peer-reviewed medical literature,[4-12] as well as extensive clinical experience with the treatment of more than 450 patients. These guidelines are intended to help individual providers determine appropriate potential candidates for this procedure and also to provide recommendations to clinical investigators researching the safety and effectiveness of SGB for treating PTSD.

Although the strength of recommendation for right-sided SGB to treat anxiety symptoms related to PTSD is currently limited to 2C, as based on case-series level of evidence reported on more than 200 patients, our experiences have demonstrated this procedure to be safe and effective with more than 70% of patients having both clinically and statistically significant relief for up to 3 months after the procedure.[10]

Patient Evaluation and Selection

To more accurately treat and analyze care provided to patients who have PTSD, the clinical or study population must first be appropriately evaluated and found to have a high likelihood of actually having PTSD. The Clinician-Administered PTSD Scale (CAPS), PTSD Checklist–Civilian Version (PCL-C), or PTSD Checklist–Military Version (PCL-M) are tools that can be used to evaluate patients for PTSD. The PCL-5, which is aligned with the Diagnostic and Statistical Manual of Mental Disorders (DSM) V, is now available. (Although we have limited clinical experience with the PCL-5, a score of 40 or greater appears to be appropriate). A positive CAPS or PCL-M (or PCL-C) score of 50 or more denotes a high likelihood of PTSD.[14]

The CAPS is the gold standard test for PTSD. However, CAPS is a time- and resource-intensive test that includes a 30-item

structured interview administered by a behavioral health clinician, and takes approximately 45 minutes to complete.[15] For study populations, a patient must have multiple CAPS to establish interrater variability if there is more than one person administering the test. Significant improvement after SGB was reported in one case series of nine patients using CAPS as the metric.[7]

Although the PCL is not the preferred metric for PTSD described in behavioral health peer-reviewed publications, the PCL is a reasonable alternative for initial and follow-up documentation by clinicians in nonstudy or limited study populations. The PCL-M (Figure 1) is a 17-question Likert scale questionnaire that takes approximately 1 minute to administer. The PCL is an adequate quantitative metric that can serve to demonstrate to providers the effectiveness of SGB.

Once the probability of PTSD is established by scale or checklist, the provider must also confirm the duration of symptoms within each of four symptom clusters (intrusion; avoidance; negative alterations in cognitions and mood; and alterations in arousal and reactivity).[13] The prime stressor should be verified through history of significant combat exposure or other traumatic event, and basic information gathered to place this

Figure 1 *Posttraumatic stress disorder checklist – Military Version (PCL-M).*

PTSD CheckList – Military Version (PCL-M)

Patient's Name: _____

Instruction to patient: Below is a list of problems and complaints that veterans sometimes have in response to stressful life experiences. Please read each one carefully, and put an "X" in the box to indicate how much you have been bothered by that problem *in the last month*.

No.	Response	Not at all (1)	A little bit (2)	Moderately (3)	Quite a bit (4)	Extremely (5)
1.	Repeated, disturbing *memories, thoughts, or images* of a stressful military experience from the past?					
2.	Repeated, disturbing *dreams* of a stressful military experience from the past?					
3.	Suddenly *acting* or *feeling* as if a stressful military experience *were happening* again (as if you were reliving it)?					
4.	Feeling *very upset* when *something reminded* you of a stressful military experience from the past?					
5.	Having *physical reactions* (e.g., heart pounding, trouble breathing, or sweating) when *something reminded* you of a stressful military experience from the past?					
6.	Avoid *thinking about* or *talking about* a stressful military experience from the past or avoid *having feelings* related to it?					
7.	Avoid *activities* or *situations* because they *remind you* of a stressful military experience from the past?					
8.	Trouble *remembering important parts* of a stressful military experience from the past?					
9.	Loss of *interest in things that you used to enjoy*?					
10.	Feeling *distant* or *cut* off from other people?					
11.	Feeling *emotionally numb* or being unable to have loving feelings for those close to you?					
12.	Feeling as if your *future* will somehow be *cut short*?					
13.	Trouble *falling* or *staying asleep*?					
14.	Feeling *irritable* or having *angry outbursts*?					
15.	Having *difficulty concentrating*?					
16.	Being *"super alert"* or watchful on guard?					
17.	Feeling *jumpy* or easily startled?					

PCL-M for DSM-IV (11/1/94) Weathers, Litz, Huska, & Keane National Center for PTSD - Behavioral Science Division
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event into context. However, the provider should adhere to basic questions, as probing or unnecessary questions can exacerbate symptoms.

1. PCL-M score ≥50, positive CAPS, or PCL-5 score ≥40? (*Note:* If score is not achieved, but patient has significant PTSD symptoms, clinician should still consider treating.)
2. Confirm duration of symptom clusters:
   - Intrusion
   - Avoidance
   - Negative alterations in cognitions and mood
   - Alterations in arousal and reactivity
3. Stressor: significant traumatic event?
   - Gather basic information for context of event:
   - Date or time period of traumatic event?
   - Number of combat deployments?
   - Experienced close quarters combat?
   - Killed enemy in combat?
   - Sexual assault?
   - Other traumatic exposure?

Providers must ask every patient about suicidal ideation or intention. Additionally, consider the diagnosis of autonomic nervous system dysfunction if the patient has significant arousal symptoms but does not meet all criteria for PTSD diagnosis.[10] Many patients with combat-related symptoms present very much like PTSD, but they may not report symptoms of "re-experiencing." Although these patients can also benefit from SGB, they should not be included in an analysis or study population evaluating the impact of SGB on PTSD. Thus, there are exceptions for treatment populations, but not for study populations.

Providers must also determine whether the patient has significant secondary gain from having a PTSD diagnosis. This is important to resolve, as these patients can influence the outcome of a treatment or study. Additionally, these patients may be resistant to receiving documentation of improvement. Answers to the following questions may assist with this issue. Is the patient:

- pending a medical board?
- pending a determination of medical disability from PTSD?
- pending a legal adverse action?
- perceiving positive social aspects of being a disabled veteran?

Providers must also establish whether the patient has significant ongoing stressors that will mask any potential benefit from SGB treatment. These patients may or may not benefit from treatment and should not be used for study populations. Stressors include:

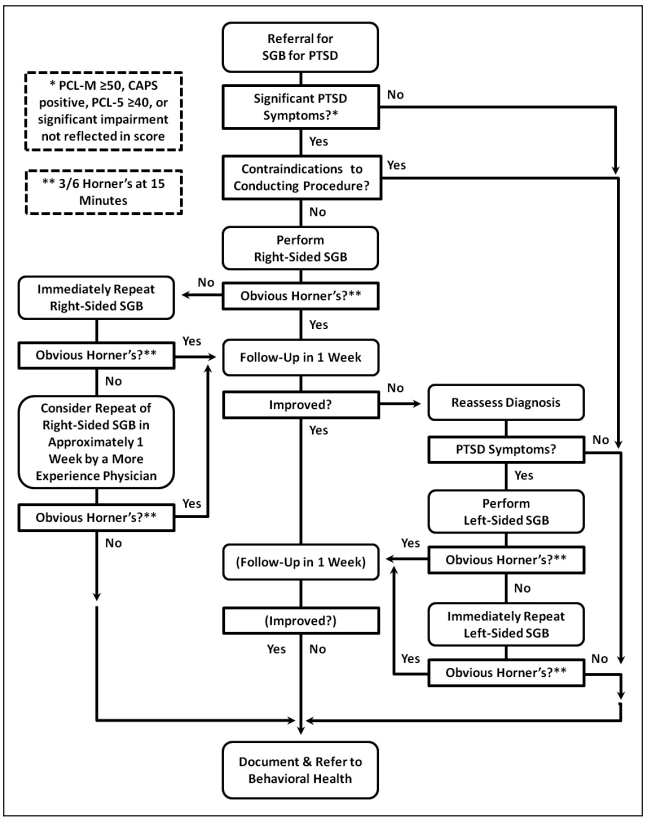
- pending adverse legal action;
- pending divorce or serious marital strife;
- pending significant anniversary of the traumatic event;
- pending trial date, if the patient was a victim;
- serious health issue in the patient or close family member;
- pending involuntary separation from the military or current job; and
- substance abuse or addiction.

Although patients may present with symptoms that appear to be consistent with PTSD, providers should realize that traumatic brain injury (TBI) symptoms overlap with PTSD symptoms. In our clinical experience, patients who have experienced a moderate to severe TBI may not directly benefit from SGB. However, patients with both a TBI and concomitant PTSD may benefit from SGB treatment.[10] If a patient has a history of mild TBI with full recovery, they should be considered for treatment and may be included in study populations.

Key Points for Treatment

Refer to Figure 2. Achieving a blockade of the cervical sympathetic chain is the goal of SGB treatment for PTSD symptoms. Attaining a dense and obvious Horner's syndrome (ptosis, miosis, scleral injection, nasal congestion, enophthalmos, anhydrosis, hyperemia) is critical for documenting a successful cervical sympathetic chain block and, therefore, having central effect on the insular cortex. Although we describe a method for ultrasound-guided SGB, the method by which the SGB is performed is not critical. The use of ultrasound guidance for SGB is well supported in the medical literature.[16-18] The following are key points to consider:

Figure 2 *Flow diagram for stellate ganglion block (SGB) treatment of posttraumatic stress disorder (PTSD).*



- Grading Horner's syndrome density with a quantitative scale. A suggested scale is as follows: up to 2 points (2 points for obvious, 1 for mild, 0 for absent) for each of the following on the side of the block only: ptosis, scleral injection, miosis. (*Note:* although anhydrosis is a standard sign of Horner's syndrome, it is difficult to quantify

without specialized equipment.) An overall score of 3–6 points can be categorized as a dense and obvious Horner's syndrome. Although we created this scale from our experience as a reasonable method for quantifying SGB block density, this scale requires validation and may need adjustment.

- When grading Horner's syndrome, make sure the patient is sitting upright and not facing a bright light. A difference in pupil size can be more difficult to establish in patients with dark iris color or if the patient is supine and facing bright ceiling lights.
- A third-party medical professional is preferred for quantitative grading of Horner's syndrome, to remove potential bias on the part of the physician performing the SGB.
- Arm temperature change after SGB is extraneous for PTSD indication because SGB is not treating an upper-limb condition.
- A patient can be determined to have Horner's syndrome at any time up to 15 minutes after the procedure. Record the number of minutes after SGB is complete. It appears to be irrelevant if Horner's syndrome occurs after 15 minutes; in our experience the resultant block will not be of sufficient density for the patient to have potential benefit.
- If the patient does not have a dense and obvious Horner's syndrome within 15 minutes, immediately repeat the block on the same (right) side.
- Our recommended dose for an ultrasound-guided SGB is 7–8mL of 0.5% ropivacaine, so the total dose for a second SGB still would be well below the toxic threshold for ropivacaine. Ropivacaine is used for its decreased toxicity compared to bupivacaine, but 0.5% bupivacaine is a reasonable alternative. If higher doses or a different long-acting anesthetic are used, ensure the total dose for the second injection is at a safe level, keeping in mind the highly vascular nature of the neck region.
- Lower doses and lower concentrations of ropivacaine (or bupivacaine) can achieve a sympathetic blockade; however, in our experience, we did not achieve an adequate clinical response despite signs and symptoms of Horner's syndrome when compared to our standard recommended dose. Thus, the "density" of the Horner's syndrome may be clinically significant.
- If the patient does not have obvious Horner's syndrome on the second attempt, consider re-attempting by another more experienced physician or different method in 1 week.
- If the SGB is successful but symptoms do not abate, strongly consider any reasonable alternative diagnosis (generalized anxiety disorder, and so forth).
- The SGB is a standard procedure for board-certified pain medicine physicians, and is widely available at many hospitals and interventional pain clinics. All current indications for SGB share the exact same level of evidenced-based recommendation as for treating anxiety symptoms associated with PTSD.[1]
- In otherwise appropriate patients that did not respond to a properly performed right-sided SGB, repeat the SGB on the left side at the same level. This is anecdotal and based on a few cases, but there appears to be a subset of the population that responds to a left-sided SGB but not a right-sided SGB. This has precedent consistent with other normal anatomic variations, and although we have a reasonably supported hypothesis on why the right-sided SGB works,[19] it appears to be a reasonable option to perform SGB on the left side in appropriate nonresponders.

There are no contraindications to treating patients undergoing concomitant therapy for PTSD. For a study population, patients should be on a stable dose of any psychoactive medication for at least 3 months. Additionally, do not initiate any new therapies for the first 3 months after SGB. However, for a nonstudy treatment population, starting therapy as indicated is appropriate. SGB has immediate effects, unlike cognitive behavioral therapy or pharmacotherapy. After SGB, ask patients to voluntarily refrain from using pharmacologic or alcoholic-beverage sleep aids if they usually use one, as they may no longer be needed.

Ultrasound-Guided SGB Procedure

The following are procedural guidelines for ultrasound-guided, right-sided SGB. This is a procedure that requires a high level of skill in ultrasound-guided injections and the ability to safely handle potential adverse events, including airway management. Specific medical credentialing for this procedure is required.

1. General preparation: Confirm that advanced cardiac life support (ACLS) equipment and capability are current and available in the procedure room. Also ensure that midazolam, which is required to rapidly abate a seizure in the event of an inadvertent vascular injection, is on the ACLS cart.

2. Informed consent: Obtain informed consent from the patient prior to conducting the procedure. Horner's syndrome is a desired effect, and if it does not occur, the injection may have to be repeated. Inadvertent temporary block of nerves innervating the larynx may occur in up to 15% of cases and may result in a temporary hoarse voice or a sensation that there is something in the back of the throat, otherwise called "globus sensation," and can last up to 10 hours following injection. Although rare, more serious complications include seizure from inadvertent injection of local anesthetic into a blood vessel, or a hematoma or localized collection of blood that could compromise the airway and result in death. If a patient experiences significant and increasing pain in the neck—more than just a mild soreness from the needle—they should understand that this is not normal and should immediately seek medical attention, as it could represent a hemorrhage in the neck. Although highly unlikely, pneumothorax has been reported with SGB. It is acceptable for the patient to talk during the injection. The patient should let the provider know if they have any new or strange sensations during the procedure, including tingling of the skin or mouth, ringing in the ears, or just feeling odd.

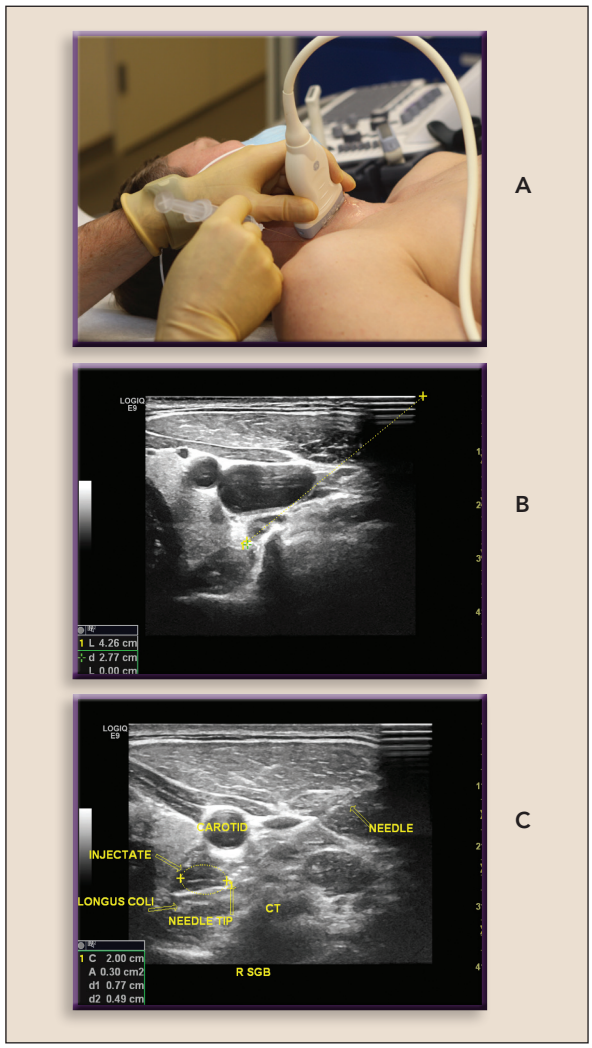
3. Procedure preparation: Secure an intravenous saline lock in a peripheral vein, connect noninvasive physiologic monitors, and place the patient in the supine position with their head rotated slightly to the left. Do not use a pillow under the head or neck. A bolster may be placed under the knees for patient

comfort. Widely prepare the skin over the anterior and right side of the neck with an alcohol and chlorhexidine solution, and allow the solution to dry for 1 minute. Perform a clinical "time out" to confirm correct patient, correct procedure, and correct side.

4. Ultrasound positioning: Apply a small amount, approximately 2 grams, of sterile ultrasound gel to the anterior neck at the level of the cricoid membrane. While seated on the right side of the patient, place a cleaned and prepared high-frequency linear transducer transverse at the level of the cricoid membrane (i.e., sixth cervical vertebra, or C6, level). Raising the procedure table to about the level of the provider's chest usually facilitates proper ergonomics. The depth of the ultrasound unit is set to visualize the ventral border of the C6 vertebral body (usually 4 cm in male patients). Identify the anterior tubercle of the C6 vertebra. The anterior tubercle of C6 has a distinct peaked appearance, and the level can be confirmed by being both at the level of the cricoid membrane and by it being the most caudad anterior tubercle (which can be confirmed with a short-axis slide in a caudad direction towards the clavicle). Identify key landmarks: the common carotid artery, interior jugular vein (facilitate viewing the entire internal jugular vein by having the patient perform the Valsalva maneuver), ventral portion of the C6 vertebral body, longus coli muscle overlying the vertebral body, longus capitus muscle (usually) overlying the anterior tubercle of C6. (*Note:* there is a high degree of anatomic variation in the anterior neck.) While in this transverse view, use power Doppler or color Doppler to scan and identify vascular structures, especially looking for the well-documented anatomic variation of a vertebral artery coursing anterior and medial to the anterior tubercle of C6.

5. Procedure: Refer to Figure 3. Envisioning a long-axis (or in-plane) lateral approach, mentally ensure the needle can reach the target area from the lateral neck. Place a skin wheal of 0.5mL buffered 1% lidocaine at the needle entry site. Using a 3.5-in long 22-gauge needle (or other appropriate needle), enter the neck with the needle in long axis to the ultrasound transducer ("in-plane" approach) going through sternocleidomastoid, continuing just ventral to the tip of the anterior tubercle of C6, then continuing on until the needle tip has just penetrated the ventral fascia of longus coli, just medial to the longus capitus muscle and dorsal to the common carotid artery. The cervical sympathetic chain usually courses along the ventral fascia of longus coli at this level, and it is sometimes, but not always, clearly visible on ultrasound. Initially aspirate to check for no blood in the hub of the needle, then slowly inject 7–8mL 0.5% ropivacaine (over 2 minutes in 0.5mL aliquots) to mitigate risk associated with potential intravascular injection. The (anechoic) injectate should flow just dorsal to the ventral fascia of longus coli. There is significant anatomic variation in the anterior neck and slight variations of this description may be required. Let the patient know that they can talk during the injection if needed. Periodically ask the patient during the injection if they are doing well, and let the patient know that questioning them is just another way to monitor how they are doing. It is absolutely critical to constantly keep the needle tip in view. If the needle tip cannot be visualized, stop the injection, reacquire needle tip visualization, aspirate while checking for no blood in the hub of the needle, and only then restart the injection.

Figure 3 *Ultrasound-guided, right-sided stellate ganglion block (SGB).* **(A)** *Transducer positioning during a long-axis (in-plane) approach to the stellate ganglion.* **(B)** *Path of the needle, going through the sternocleidomastoid, under the internal jugular vein, through the longus capitus muscle just ventral to the anterior tubercle of C6, and into the ventral fascia of the longus coli muscle, laying immediately ventral to the body of the C6 vertebra.* **(C)** *Long-axis needle approach, with the needle tip in the ventral fascia of longus coli.*



6. Observation and monitoring: Observe and monitor the patient for at least 30 minutes after completion of the injection. Have the patient remain in the supine position (a pillow may be used at this time). The first sign of a successful block will often be a sensation change on the right side of the face. Once signs and symptoms of Horner's syndrome are evident, the patient may sit reclined at a 20° angle for the remaining observation period. These positions may facilitate productive anesthetic spread. Record the patient's initial response to the injection, the time at which an obvious Horner's response was evident, and the quantitative score of the Horner's syndrome. Approximately 20 minutes after the Horner's response is evident, inquire how the patient feels "mentally." Usually patients report some variation of feeling "relaxed, light, and calm." An additional but optional step is to help the patient

understand what happened with a successful SGB. Let them know that the relaxed feeling after SGB is similar to the light feeling that occurs after taking off a heavy backpack. There is nothing in a backpack that makes one feel light, it is the absence of the backpack that makes one feel light. Similarly, there is nothing in local anesthetic that makes one feel relaxed, what they are experiencing is the absence of their chronically activated "fight or flight" response. It appears that SGB "resets" this chronic inappropriate sympathetic tone for a long time.[9] This explanation has proven useful for describing how SGB works, although the exact mechanism is not known at this time. Record the results of the initial PTSD evaluation (CAPS or PCL), procedure note with quantitative score of the resultant Horner's syndrome, and additional examination and findings in the patient's medical record. Re-emphasize appropriate precautions to the patient before discharge.

Patient Follow-up

Quantitative follow-up after SGB is critical, and should be conducted at 1 week, 1 month, and 3 months. The natural history is that many cases of PTSD will significantly resolve by 1 year without treatment. Therefore, studies with long-term follow-up (i.e., more than 3 months after SGB) will require significantly larger numbers to show an effect, as long-term follow-up will mask an effect in smaller studies. In our opinion, showing significant benefit out to 3 months is sufficient to justify the procedure. The patient's response to SGB determines possible future therapy with SGB.

Input from family, close friends, or work colleagues on any change in the patient's condition can prove invaluable. This may be difficult to formally obtain in study populations. In our experience, spouses, friends, and colleagues have noted significant improvements in the patient that the patient is not aware of. A potential option is to request study subjects to ask their family or trusted friends if they have noticed any changes prior to the subjects completing follow-up monitoring. Consider using a formal instrument given to spouses before and 1 month after SGB.

SGB is not a "cure" for PTSD, and symptoms may return with an incidental trigger. If the patient has a documented positive response from SGB, they have a high likelihood of receiving benefit from retreatment.[10] For SGB nonresponders who had a documented dense Horner's syndrome after SGB, wait at least 2 weeks after the initial right-sided SGB before further treatment. Additionally, reconsider the diagnosis of PTSD and the suitability of the patient for SGB, as discussed earlier in this article.

Consider treating the patient with additional SGBs if the patient has had a documented and significant improvement from SGB lasting at least 1 month. Additionally, consider using the policy of "no follow-up documentation, no second treatment." Explain this policy to the patient to help get patient buy-in for appropriate follow-up monitoring. Explain that although the risks involved with an SGB are very low, there is still some risk of a significant complication and that documentation of even transient improvement is needed to justify the small risk involved with a repeated treatment. Follow-up by electronic transmission of the PCL-M (or PCL-5) form can be done if the patient is deployed.

Discussion

When reading the medical literature pertaining to SGB for PTSD, consider if the study cohort is like the patient population being assessed for treatment and whether the study conclusions can be generalized to your patient population. Most of the patients we treated and reported in the medical literature were active duty military personnel who wanted to remain on active duty and were not seeking any form of discharge or disability benefit.

At the 2015 American Academy of Pain Medicine Annual Meeting, McLay et al presented their findings from a randomized controlled trial of 42 patients that compared SGB to a sham injection for the treatment of PTSD symptoms.[20] Their study results showed PTSD symptoms improved significantly for both groups following treatment; however, there was no statistical difference between SGB and sham. Variations in procedure technique and dosing, as well as variations in study participant motivation and characteristics, may have had some degree of influence on their results; thus, additional study of SGB is still warranted.

It has been a challenge to get some behavioral health providers to accept SGB therapy. This may be overcome with consistent emphasis that SGB is used only to reduce chronic inappropriate sympathetic tone, thereby potentiating other behavioral health therapies for PTSD. Our message has always been that SGB is not a cure for PTSD; it is only one part of an effective treatment plan for PTSD.

Subjectively, SGB therapy is highly accepted by our patients, and they may not want other forms of treatment even if they could benefit from them; this is a choice of the patient. Military patients are concerned with any treatment, especially pharmaceutical, that may result in a decrease in physical or mental performance or potential decrease in battlefield survivability. Our recent case series documents no degraded performance in reaction time, motor quickness, vigilance, memory, or concentration after SGB, and actually showed an improvement in these measures.[12] Our ongoing studies include a large-scale, multicenter, randomized controlled trial to further assess safety and efficacy.

Eliminating the stigma some individuals associate with PTSD remains an important part of treating the military community. Military leaders and healthcare providers must convey a clear and consistent message to the patient that having PTSD does not convey failure or weakness. Their PTSD was a result of their service to their country under extreme circumstances or a traumatic event they had no control over. These patients need to understand that this diagnosis alone will not negatively affect their security clearance or future service in the Department of Defense.

Conclusion

Based on comprehensive review of the medical literature and extensive first-hand experience with this procedure, we present these clinical guidelines to assist providers with determining the suitability of SGB for PTSD in their patient populations.

Additionally, we provide details that may assist clinical investigators researching the safety and effectiveness of SGB for the treatment of PTSD.

Disclaimer

The views, opinions, and findings contained in this manuscript are those of the authors and should not be construed as official or reflecting the views of the Department of Defense unless otherwise stated.

Disclosure

The authors have nothing to disclose.

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