# STELLATE GANGLION BLOCKS (SGB)

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## NERVOUS SYSTEM OVERVIEW

The nervous system is divided into two branches, the central nervous system and the peripheral nervous system. The central nervous system includes the brain and spinal cord and is primarily responsible for initiating, planning, and coordinating actions. The peripheral nervous system includes the nerves and ganglia (nerve clusters) that extend to the peripheral organs (i.e. muscles, glands, digestive organs, reproductive organs, etc) (1). The peripheral nervous system is further divided into two branches, the afferent (sensory) and efferent (motor or movement) divisions (2). Both the afferent and efferent divisions are subdivided into two branches, the autonomic and somatic nervous systems. The somatic nervous system is responsible for controlling skeletal muscle movements and is often referred to as the voluntary nervous system. The autonomic nervous system (ANS) regulates a wide range of involuntary physiological responses and can be further divided into two segments: the sympathetic and parasympathetic nervous systems (2).

The two branches of the ANS are responsible for producing antagonistic physiological effects, and the ganglia (nerve clusters) associated with the ANS essentially act as a junction between the nerves originating from the central nervous system and the nerves innervating their target organs in the periphery. The sympathetic ganglia deliver information to the body about stress, impending danger and fear. These ganglia are responsible for the physiological responses to these stimuli, commonly known as the “fight-or-flight” response. Alternatively, the parasympathetic ganglia produce antagonistic physiological responses in order to maintain a steady-state, commonly known as the “rest-and-digest” response.

## SYMPATHETIC NERVOUS SYSTEM

The stellate ganglion (SG) is a nerve cluster associated with the sympathetic nervous system. The SG is located in the upper neck and functions to coordinate with the central nervous system to produce sympathetic physiological responses. Signals from the SG are transmitted to a wide range of peripheral targets, including the heart, eyes, sweat glands, and pain receptors (3, 4, 5). As such, the SG has a major role in carrying out sympathetic nervous system responses. In healthy, normally functioning individuals, “fight-or-flight” responses are associated with appropriate stimuli, such as an increase in sweating and heart rate when running from a bear or while slamming on the brakes to avoid a car accident. Further, mental or emotional stress has been shown to stimulate the sympathetic nervous system and elicit similar physiological responses to physical stress (6, 7, 8). The sympathetic nervous system is essential to normal functioning and survival because these physiological responses liberate extra energy and equip the body to deal with emergency situations. Despite this vital role, overstimulation of the sympathetic nervous system can result in altered SG signaling and can therefore lead to dysfunctional or inappropriate physiological responses (9).

## PTSD AND SYMPATHETIC OVERDRIVE

Unfortunately, the physiological manifestations of sympathetic stimulation do not exclusively occur as a response to appropriate stimuli for individuals with Post-Traumatic Stress Disorder (PTSD) or Anxiety (10). Many studies have evidenced that both PTSD patients and patients with anxiety have overactive sympathetic reactivity and activity during mental stress and under resting conditions (10, 11, 12, 13). Individuals with overactive sympathetic reactivity experience heightened physiological responses to stressors. These magnified responses underscore the physiological basis of symptoms reported by patients with PTSD or anxiety (13). Exposure to or experiencing traumatic events can lead to debilitating and life-altering PTSD or anxiety symptoms that originate from the overactivity of the "fight-or-flight" response (12, 13). Research suggests that the recurrent trauma-related symptoms experienced by PTSD patients may be a result of enhanced and prolonged sympathetic stress responses (12, 14).

## STELLATE GANGLION BLOCK FOR PTSD AND ANXIETY

Conventional treatments for PTSD and anxiety are centered around psychological therapy in combination with pharmacological treatments (i.e. antidepressants, antipsychotic drugs, and/or mood stabilizers) (15). Although some patients may find these conventional treatments adequate for symptom relief or even symptom remission, many patients with PTSD and patients with anxiety continue to struggle managing their symptoms despite seeking care. Fortunately, neuroscience research has revealed a new therapeutic avenue for individuals with PTSD and anxiety. For many years, Stellate Ganglion Blocks (SGB) has been safely and widely used as a minimally-invasive treatment option for many medical conditions ranging from peripheral vascular disease to refractory ventricular tachycardia (16, 17). More recently, however, SGBs have been shown to have significant and long-lasting symptom relief for patients with PTSD and anxiety (18-21). The SGB procedure is able to successfully treat PTSD and anxiety symptoms by anesthetizing the physical source of trauma-related symptom sympathetic overdrive, the stellate ganglion nerve cluster. SGBs are able to effectively "reset" the sympathetic nervous system and restore normal biological function, providing patients with rapid and significant symptom relief of even the most severe trauma-related symptoms. When used in conjunction with trauma-focused psychotherapy, SGBs have a 70%-80% success rate in treating anxiety and PTSD symptoms (19, 22, 23).

ADD A PARAGRAPH HERE FOR WHAT OTHER USES SGB ARE FOR - PALPITATIONS, CPPS, ETC

SGBs have also been used to treat sympathetic nervous system-related conditions of the head, neck and upper body ranging from cardiac applications to complex regional pain syndrome (CRPS) (24, 25). SGBs have been shown to reduce symptoms related to sympathetic overdrive in drug-refractory electrical storms due to ventricular arrhythmia (a condition that involves recurrent ventricular arrhythmias) and inappropriate sinus tachycardia (elevated heart rate) (24,

26). As both of these cardiac conditions produce sympathetic-related symptoms that are notoriously difficult to treat because patients often do not respond to medical therapy, SGBs provide patients with an alternative treatment option that reduces morbidity and mortality (24, 26, 27). Further, SGBs can be used to treat CRPS, a chronic pain condition in which patients complain of characteristic symptoms like allodynia (extreme sensitivity to touch), hyperalgesia (extreme response to pain), sudomotor (autonomic nervous system abnormalities such as increased sweating) and vasomotor abnormalities (changes in skin temperature) following an injury, trauma or surgery (28, 29). Many CRPS symptoms involve dysregulated sympathetic nervous system responses, and CRPS is formerly known as "reflex sympathetic dystrophy" (28). As SGBs help “reset” the sympathetic nervous system, these procedures can produce long-lasting and sustained pain relief of CRPS symptoms (30, 31). In addition, SGBs have been shown to reduce acute pain and incidence of postherpetic neuralgia, the most common complication of shingles (herpes zoster virus infection) that results in prolonged burning pain after the shingles rash disappears (32). SGBs have a wide range of clinical applications and offer patients an alternative treatment option for when other therapies fail to provide adequate symptom relief.

## STELLATE GANGLION BLOCK PROCEDURE

Stellate Ganglion Blocks are widely studied and highly effective minimally-invasive outpatient procedures performed under monitored care anesthesia (light sedation). Using x-ray fluoroscopy and ultrasound, a small needle is guided into the neck region that contains the stellate ganglion nerve cluster. Once the needle position is confirmed, a local numbing anesthetic (e.g. bupivacaine or lidocaine) is injected into the stellate ganglion. The entire procedure is performed under ultrasound guidance and takes an average of 20 minutes to complete (33). Although the effects of the local anesthetic wear off within 8-12 hours, a single SGB has been shown to provide immediate symptom-relief that lasts several weeks or months (21). Many patients only require a single procedure to effectively alleviate their PTSD or anxiety symptoms, but two to three procedures spread over several years is also common (33).

## CONCLUSION

PTSD and Anxiety are chronic mental disorders that can severely impact quality of life, and traditional treatment options fail to address the physical changes that occur as a result of these conditions. Stellate Ganglion Blocks provide patients with a safe and effective treatment option for PTSD and anxiety, and clinical data has repeatedly shown that SGBs produce powerful and long-lasting symptom relief. By collaborating with mental health professionals, the Anesthesiologists at Hudson Medical offer SGBs to patients struggling to manage their PTSD and Anxiety symptoms.

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