PAIN MEDICINE CASE REPORTS

ISSN 2768-5152

Volume 5, Number 1, pp. 45-49

Received: 2020-02-25
Accepted: 2020-06-23
Published: 2021-01-31

# When Options are Limited: Case Report of an Ultrasound Guided Stellate Ganglion Block at Bedside

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**Background:** Stellate ganglion block is an option for refractory ventricular tachyarrhythmia. Approaches include using anatomical landmarks or image-guidance with fluoroscopy, computerized tomography, magnetic resonance imaging, or ultrasonography.

**Case Report:** We describe a case of a 70-year-old man with multiple comorbidities presenting with sustained ventricular tachycardia (VT) who received a cervical sympathetic chain block at bedside. This resulted in ablation of his refractory VT and return to a paced rhythm, allowing him to be discharged from the intensive care unit.

**Conclusion:** This case shows the advantages of targeting the cervical sympathetic chain to block the stellate ganglion in a high-risk patient. Doing the procedure under ultrasound guidance allows for real-time visualization with the advantage of being performed at the bedside. Therefore, a cervical sympathetic chain block should be considered for treatment of refractory ventricular arrhythmias.

**Key words:** Cervical sympathetic chain, refractory ventricular tachyarrhythmia, stellate ganglion block, ultrasound guidance

## BACKGROUND

Stellate ganglion block is an option for refractory ventricular tachyarrhythmia. In addition to treating upper extremity sympathetic mediated pain, a number of case reports have demonstrated its effects on refractory arrhythmias (1-4). Multiple approaches have been described. These include the paratracheal approach with anatomical landmarks or the use of imaging such as fluoroscopy, computerized tomography, magnetic resonance imaging, or ultrasonography (1). Image-guidance procedures allow for improved accuracy, especially given the close proximity to vascular structures. Few studies describe the use of ultrasonography for the stellate ganglion block. Many advantages exist with this method, which can be both easily taught and performed. This method allows for blockade of the cervical sympathetic

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Disclaimer: There was no external funding in the preparation of this manuscript.
Conflict of interest: Each author certifies that he or she, or a member of his or her immediate family, has no commercial association (i.e., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted manuscript.

chain. At this location, local anesthetic is able to spread to the C7-T1 level where the stellate ganglion resides, causing blockade. We describe a case using ultrasonography to block the stellate ganglion for refractory ventricular tachycardia (VT) at the bedside. Written Health Insurance Portability and Accountability Act (HIPAA) authorization was obtained from the patient for publication of this case report.

## Case

The patient is a 70-year-old man with history of hypertension, hyperlipidemia, reduced ejection fraction heart failure due to ischemic cardiomyopathy and complicated by ventricular fibrillation arrest status post implantable cardioverter-defibrillator, complete heart block status post cardiac resynchronization therapy defibrillator implantation, and persistent ventricular fibrillation/VT storm. He presented with orthostatic hypotension, dizziness, and concern for decompensated heart failure vs overload. Patient was found to be in sustained monomorphic VT (Fig. 1). Previously, he had undergone multiple unsuccessful ablations. During his hospitalization, attempts were made for overdrive pacing. Medications were adjusted, including discontinuing his home medications of sotalol and flecainide. Amiodarone load and infusion were initiated in which he subsequently converted into a ventricular paced rhythm with rates in the 90s. He was unable to tolerate amiodarone due to gastrointestinal side effects and concern for acute liver injury. The amiodarone infusion was subsequently discontinued. Given the difficulty of controlling his VT with pharmacotherapy, the acute pain team was consulted for a stellate ganglion block. He also resumed sotalol and flecainide.

Stellate ganglion block was performed for recurrent monomorphic VT. The procedure was done at the patient's bedside in the cardiac intensive care unit (ICU). The patient had standard monitors on including an electrocardiogram, blood pressure, and pulse oximetry. The patient's anatomy was examined with ultrasound to identify the internal jugular vein, carotid artery, external jugular vein, surrounding musculature, and skeletal anatomy. At the level of the transverse process of C6, the cervical sympathetic chain was identified below the prevertebral fascia between the longus colli and longus capitis muscle (Fig. 2). The prevertebral fascia was then traced caudad to the level of C7, where the procedure was performed (Fig. 3). A 50-mm, 22-gauge (G) echogenic, stimulator needle was slowly advanced under ultrasound guidance and directed posteriorly to the level of the longus colli muscle. An injection of 5 mL of 0.5% ropivacaine was deposited below the prevertebral fascia.

Following the procedure, his ventricular arrhythmia was terminated. He returned to his previous ventricular paced rhythm at a rate of 90 with an underlying sinus bradycardia (Fig. 1). The patient was discharged from the hospital 2 days later. He was continued on sotalol and flecainide and remained in this rhythm for approximately 6 weeks. The patient and his family were very satisfied with the results and management of his arrhythmia.

## Discussion

Stellate ganglion block has demonstrated success in suppressing refractory ventricular arrhythmymias (1-5). Schwatrz et al (6) first showed that denervation of the cardiac sympathetic innervation leads to increased


Fig. 1. Image A shows the ECG upon admission prior to amiodarone and the cervical sympathetic chain block. Image B shows the ECG following stellate ganglion block showing paced rhythm at 90.
Abbreviation: ECG, electrocardiogram

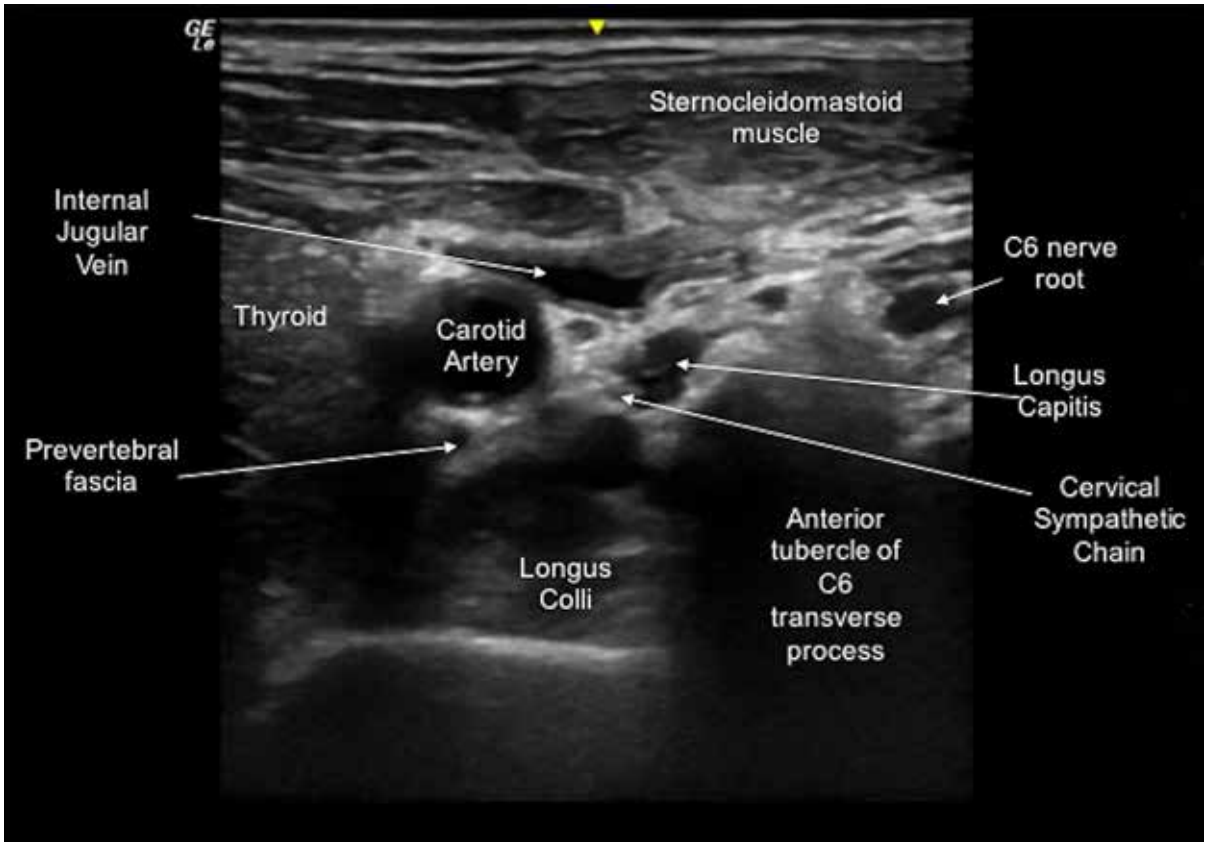


Fig. 2. Cervical sympathetic chain and surrounding structures at the level of C6.

threshold for ventricular arrhythmias. Since then, techniques have been developed to target the stellate ganglion either with landmarks or with image guidance. The advantages of inhibition of the sympathetic nervous system have been shown compared to antiarrhythmic therapy as seen in standard cardiac life support during electrical storm (2). Furthermore, surgical intervention involving interruption of the sympathetic nervous system can decrease arrhythmias (5). Despite this, not all patients are candidates to undergo surgical intervention.

The stellate ganglion is formed from the inferior cervical and the first thoracic ganglia. It provides sympathetic innervation to the head, neck, heart, and upper extremities. Stellate ganglion block has been used for pain syndromes, upper extremity vascular insufficiency, and for treatment of long QT syndrome (3). The majority of the sympathetic innervation to the heart is from both the left and right stellate ganglia; however, at the ventricular level, the left-sided sympathetic nerves are dominant (7). Furthermore, left cardiac sympathetic denervation results in increased vagal activity to the heart (7). It has also been reported that left-sided stellate ganglion block may shorten the QT interval, whereas right-sided block may actually lengthen the QT interval (8). Therefore, by shortening the QT interval, this would be beneficial for those at risk of torsades de pointes and other arrhythmias. Taken together, left-sided blockade may be useful in patients with or at high risk of life-threatening arrhythmias.

Multiple studies have described the stellate ganglion block using landmarks or fluoroscopy (1,4). With this technique, many have described using volumes of local anesthetics as high as 20 mL. Wulf et al (9) described concerns with this volume in high-risk patients. Few studies have described the use of ultrasound-guided cervical sympathetic chain or stellate ganglion block (3). With this modality, a smaller volume is needed, typically only 5 mL of local anesthetic. This low volume of local anesthetic may

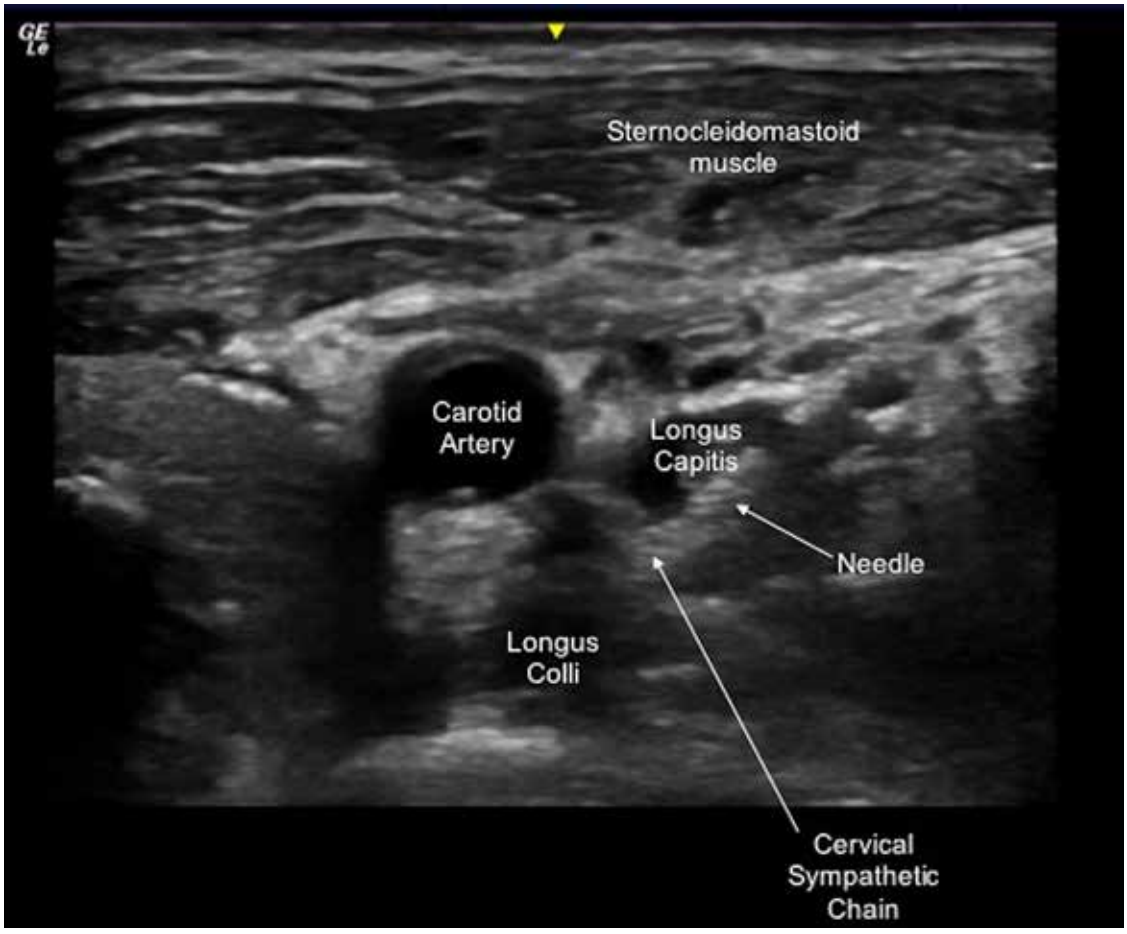


Fig. 3. Needle identified with the tip posterior to the longus colli muscle at the cervical sympathetic chain at the level of C7..

reduce potential side effects such as unilateral ptosis, hemifacial flushing/redness, and hoarseness of voice associated with this block.

In addition, ultrasound-guidance allows for real-time visualization of the structures, needle placement, and local anesthetic deposition. Narouze et al (10) described a case where ultrasound-guidance helped prevent esophageal puncture in a patient with asymptomatic pharyngoesophageal diverticulum. By performing the procedure with real-time visualization, they were able to avoid the esophagus, thyroid, vessels, and other surrounding structures (10). When comparing stellate ganglion block under fluoroscopy or ultrasound guidance in patients with upper extremity complex regional pain syndrome, Imani et al (11) did not find a statistical difference between the 2 groups in terms of weekly pain attacks or pain intensity. They demonstrated a correlation suggesting fewer complications and greater improvement of the patient's disability indexes using ultrasound-guidance (11). This suggests the effective use of ultrasound-guided stellate ganglion block in comparison to using fluoroscopy, although larger studies are needed.

Ultrasound-guided stellate ganglion block can be done at the bedside and does not require coordination with the fluoroscopy suite or personnel. One case report describes the use of ultrasound-guided stellate ganglion block in an infant with recurrent ventricular fibrillation (12). This ultrasound-guided procedure was not only able to be performed on an infant but also in the cardiac ICU (12). The ability to perform this procedure at the bedside is particularly advantageous for unstable patients or those who may need frequent nerve blocks. Furthermore, these high-risk patients are anticoagulated and restrained to the ICU with very few options of treatment. An ultrasound-guided cervical

sympathetic chain and stellate ganglion block in an anticoagulated patient in the ICU may be a viable option in this high-risk population.

In conclusion, cervical sympathetic chain block under ultrasound guidance is a feasible and safe procedure and should be considered for treatment of refractory ventricular arrhythmias. It provides real-time visualization with the advantage of being performed at the bedside. Further studies are needed to investigate the safety and efficacy of this procedure.

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