

Pulsed Radiofrequency of Stellate Ganglion Using Ultrasound Guidance for Pain Control in Patients With Upper Limb Complex Regional Pain Syndrome: A Retrospective Observational Study

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Introduction

Chronic Regional Pain Syndrome (CRPS) is a wide spectrum of painful conditions which usually occur after an initiating event and diagnosed clinically (1).

S.W Mitchell was the first physician who reported the first CRPS patient in 1864 under the term of "causalgia" (2). In 1995, Stanton et al called the disorders, including reflex sympathetic dystrophy (RSD) and causalgia, CRPS after a common decision from a conference in Orlando (3).

This syndrome has been diagnosed more frequently in women between 40 to 60 years of age after injuries (2). This is a neurological disorder and, in most of the cases, will end up causing debilitating pain (4). Changes will happen in the sympathetic, motor nervous system and somatosensory system, causing severe pain and disability (5). Signs and symptoms are often in the distal part of the extremities (5). Based on expert panel U.K. guidelines for CRPS, the Budapest Criteria is used for the diagnosis of CRPS (6).

Methods

This retrospective observational study of patients who were admitted to Allevio Pain Management between January 2013 and December 2018 underwent stellate ganglion pulsed radiofrequency (PRF) for the condition of CRPS. A total number of 19 patients underwent an ultrasound guided stellate ganglion block for upper limb CRPS. Patients who responded with a positive diagnostic block either proceeded to have regular treatment with PRF of the stellate ganglion or had repeated stellate ganglion blocks, who then transitioned to PRF later.

All patients with CRPS diagnosis and SGRN were included. This project was conditionally approved by Veritas IRB Inc.

Baseline	
	Total (n=19)
Age, years (median, IQR)	48 (40.5 - 56.5)
Age categories	
20-39, n (%)	4 (21.1)
40-59, n (%)	11 (57.9)
≥60, n (%)	4 (21.1)
Gender	
Male, n (%)	8 (42.1)
Female, n (%)	11 (57.9)
Narcotic Use	
No	10(52.6)
YES	9(47.4)
Dosage (if YES), (median, IQR)	35(27.0 - 94.5)
Follow up	
	Total (n=19)
Work Status	
Returned to work, n (%)	8 (47.1)
Pain relief duration, months (median, IQR)	2.0 (2.0 - 3.0)

Results

From 2013 to 2018 in the Allevio Pain Management clinic, 19 patients with CRPS underwent the SGRN. All 19 charts were reviewed.

The median age of study participants was 48 years (IQR: 41-57), about 79% (n=15) were younger than 60 years, and 42% (n=8) were males (Table 1). At the time of intervention, the baseline median scores for pain intensity and interference were 7.0 (IQR: 6.5-8.3) and 7.6 (IQR: 7.0-8.8) respectively.

After the intervention, pain intensity (median: 0.0, IQR: 0.0 – 2.5, p-value<0.001) and interference scores (median: 2.6, IQR: 1.9 – 5.1, p-value<0.001) dropped substantially (Table 2). The median drop for pain intensity and interference was 6.5 (IQR: 4.2-8.3) and 3.7 (1.7- 6.4) respectively and statistically significant (Table 2, Figures 1-2). Of all pain interference items, the greatest improvement was observed in working and sleeping items.

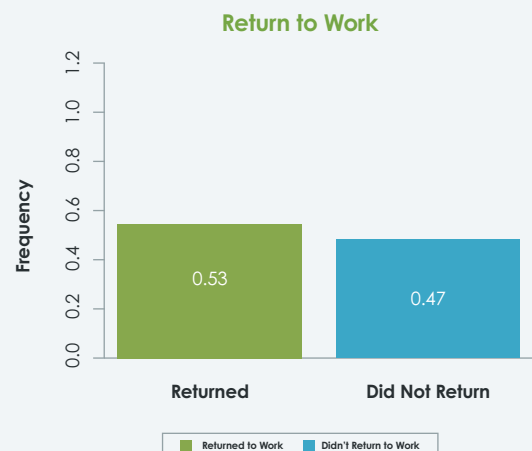
Over half of the patients experienced clinically meaningful improvements ($\geq 50\%$ reduction in pain score) across all seven items of the pain interference domain (Table 3). The median pain-free period was two months (IQR: 2.0 – 3.0). Eight out of 17 patients returned to work after the intervention (data for the remaining two patients working status was missing) (Table 1).

Before intervention, 9 out of 19 patients were using narcotic analgesics. Dosages varied substantially between subjects (13.5mg to 200mg). Only one patient, who did not use analgesics before, indicated narcotic analgesic usage after the SGRN. Two out of 19 patients indicated that they had an emergency room (ER) visit due to pain during the follow-up period.

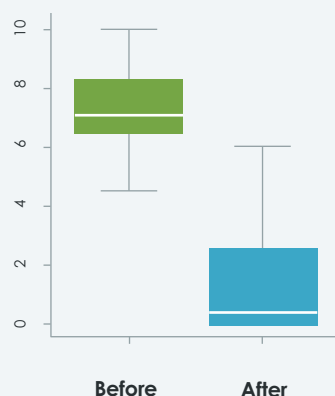
Discussion

Sympathetic blocks, such as SGB, may allow short-term clinical improvement in some patients with sympathetically mediated pain, permitting more active physiotherapy during that period. If a diagnostic sympathetic block is successful, a series of three to six blocks is usually administered to augment physical therapy. Each time a SGB is performed, there are associated risk factors and anticipated side effects of Horner's syndrome.

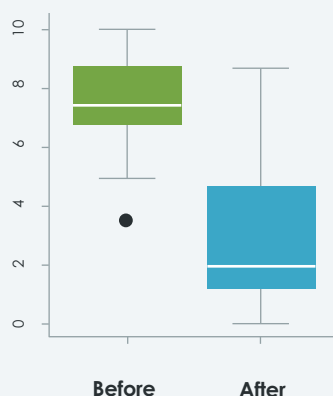
- Based on the above retrospective results, over half of the patients had a greater than 50% reduction in pain with a median duration of approximately two months after PRF of the stellate ganglion.
- There was a significant improvement in the quality of life based on post treatment brachial plexus injury (BPI) results.
- These results offer an alternative to repeated stellate ganglion nerve blocks, hence reducing the number of injections and potential complications.
- The implied safety of PRF avoids thermocoagulation causing neuronal destruction and potential for worsening neuralgia. The actual mode of action of PRF is still debated, but it has been suggested from initial studies by Teixeira in 2005, who hypothesized an anti-inflammatory component showing reduction in pain with intraarticular application of PRF.



Pain Intensity Score



Pain Interference Score



	Pre-intervention (n=19)	Post-intervention (n=19)	Change in Score	P-value*
Pain intensity composite score, (median, IQR)	7.0 (6.5-8.3)	0.0 (0.0-2.5)	6.5(4.2-8.3)	<0.001
Pain interference composite score, (median, IQR)	7.6 (7.0-8.8)	2.6 (1.9-5.1)	3.7 (1.7-6.4)	<0.001
General activity	8.0 (7.0-9.5)	3.0 (2.0-6.0)	4.0 (2.0-6.0)	<0.001
Mood	8.0 (7.5-9.5)	3.0 (2.0-6.5)	4.0 (2.0-6.0)	<0.001
Walking	6.0 (0.0-8.0)	1.0 (0.0-4.0)	1.0 (0.0-6.0)	0.025
Working	10.0 (8.0-10.0)	3.0 (2.0-5.5)	6.0 (3.0-7.0)	<0.001
Socializing	8.0 (6.0-9.0)	3.0 (2.0-5.0)	3.0 (1.5-6.0)	<0.001
Sleep	9.0 (7.5-10.0)	3.0 (2.0-5.5)	5.0 (2.0-7.0)	<0.001
Enjoyment in life	10.0 (6.5-10.0)	4.0 (2.0-6.0)	4.0 (2.0-7.5)	<0.001

Conclusion

Ultrasound guided technique of PRF of stellate ganglion offers a peripheral neuromodulation with the potential of extended pain relief to allow continuous rehabilitation and functional restoration. The use of ultrasonography improves safety of the procedure demonstrating visualization of related anatomical structures and minimizing risk of injury to important structures such as the thyroid artery, esophagus, spinal cord, pleura, and vertebral artery. Only patients that had a positive stellate ganglion block were transitioned to the PRF.

A future study may be worth considering all patients with confirmed CPRS to be treated with PRF, as the hypothesized mechanism action is unique in comparison to stellate ganglion block. Therefore, using a positive SGB to screen patients for PRF treatment may not be a suitable prerequisite, and it may disqualify patients who may otherwise benefit from the treatment.

Like most chronic pain conditions, successful management requires a multidisciplinary approach with a big emphasis on functional restoration to reduce disability and hence improve the quality of life. More research and larger studies are still required to further our understanding and develop our armory for the future.

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