

Efficacy of T2-T3 Thoracic Sympathetic Block for Management of Complex Regional Pain Syndrome 1

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Abstract

Background: This study is performed to evaluate the efficacy of radiofrequency ablation of T2-T3 Thoracic Sympathetic block for pain management of Complex Regional Pain Syndrome 1.

Material and Methodology: We performed first stellate ganglion block for all patients in CRPS1. Those patients who have reduce pain score less than 50% was considered for diagnostic T2-T3 Thoracic Sympathetic Block. We had done Radiofrequency Ablation in patients who have pain relief more than 50% pain relief in diagnostic T2-T3 block. We have recorded to VAS pain score and requirement of analgesic dose of drugs among patients before and after Radiofrequency Ablation.

Results: Treatment produced a significant reduction in pain score, VAS value and significantly reduce in dose of analgesic drugs.

Conclusions: The study of 18 patients shows that T2-T3 thoracic sympathetic block is effective in CRPS 1 who has inadequate pain relief in stellate ganglion block. Radiofrequency Ablation gives long term pain relief and decrease dosages of analgesic drugs.

Abbreviations

T2-T3	Thoracic 2 and Thoracic 3
CRPS	Complex Regional Pain syndrome
RSD	Reflex Sympathetic Dystrophy
IASP	International Association for the Study of Pain
SMP	Sympathetically Mediated Pain
SIP	Sympathetically Independent Pain
CNS	Central Nervous System
PNS	Peripheral Nervous System
NSAIDS	Non-Steroidal Anti Inflammatory Drugs
SNBs	Sympathetic Nerve Blocks
SGB	Stellate Ganglion Block
TSB	Thoracic Sympathetic Block
RF	Radio Frequency
RFTC	Radio Frequency Thermo Coagulation
VS	Versus
NA	Nor Adrenaline
5-HT	5 -Histamine 5 –hydroxyl tryptamine
DRG	Dorsal Root Ganglion
S1	Sacral root 1
S2	Sacral root 2
IL-6	Interleukin 6
TNF Q	Tumour Necrosis Factor Q
IL-1b	Interleukin 1-b
PET	Positron emission Tomography
MEG	Magneto Encephalo Graphy
HLA DR 13	Human Leukocyte Antigen DR13
HLA -DQ1	Human Leukocyte antigen DQ1
LA	Local Anaesthetic

COX	Cyclooxygenase
COX 1	Cyclooxygenase 1
COX 2	Cyclooxygenase 2
COX 3	Cyclooxygenase 3
PG E	Prostaglandin E
PG I	Prostaglandin I
LTB	
GIT	Gastro Intestinal Tract
GI	Gastro Intestine
RS	Respiratory System
CVS	Cardio Vascular System
NOP	Nociceptin Orpharin FQ Peptide
NE	Nor Epinephrine
SR	Serotonin
NMDA	N-Methyl D-Aspartate
MAO	Monoamine Oxidase
SNRIs	Serotonin Norepinephrin Reuptake Inhibitors
SSRIs	Specific Serotonin Reuptake Inhibitors
TCAs	Tricyclic Antidepressants
FDA	Food and Drug Authority
PHN	Post Herpetic Neuralgia
GABA	Gamma Amino Butaric Acid
C/I	Complain of
IVRA	Intra Venous Regional Anaesthesia
SCS	Spinal Cord Stimulation
Hz	Hertz
V	Voltage
%	Percentage
Cc	Cubic Centimetre
Sec	Second
Min	Minute
KHz	Kilo hertz
Mm	Millimetre
G	Gauze
VAS	Visual Analogues Score
Mg	Milligram
Tab	Tablet
Inj	Injection
CBC	Complete Blood Count

Introduction

Complex regional pain syndrome [CRPS] was once known as reflex sympathetic dystrophy [RSD] and causalgia [1]. The International Association for the Study of Pain (IASP) suggested a new nomenclature, CRPS, with two subtypes, which deliberately avoid suggesting etiology or site [2]. CRPS 1 (RSD) is defined as a syndrome that usually starts after a noxious event, is not limited to the distribution of a single peripheral nerve, and is disproportionate to the inciting event [3]. CRPS 2 (causalgia) is defined as a syndrome that starts after a nerve injury and is not necessarily limited to the distribution of the injured nerve [3]. Despite these changes, CRPS has generated significant research interest [4]. One issue that continues to evolve is the role of interventional therapy in managing CRPS [5]. The sympathetic nervous system has been implicated in the pathophysiology of CRPS 1 and consequently, sympathetic nervous system blockage is widely used to treat CRPS 1 [6].

The current view is that, when necessary, interventional administered in a timely manner may help relieve pain and facilitate the primary goal- functional rehabilitation of the affected limb [7].

A review published by Cepeda et al. [6] revealed that scarcity of published evidence to support the use of local anesthetic sympathetic blockade as the gold standard treatment for CRPS.

According to Sandroni incidence of CRPS I 5.46 new cases/100000 annually (8). According to IASP incidence is 25.2 new cases/100000 annually (8). Period prevalence is 20.57/100000 5. Female: male was 4:1, mostly 50-70-year age with median age of 46 years at onset (9). Upper limb was affected twice as commonly as lower limb (9).

Even though the pathophysiology is not clearly defined. (10) The syndrome may be mainly a systemic disease involving the central and peripheral nervous system, yet the specific interaction between the central and peripheral mechanisms is unclear (10). The postulated mechanisms include: Inflammation, Afferent dysfunction, Central dysfunction & Sympathetic dysfunction.

CRPS mainly diagnosed by IASP Diagnostic criteria for CRPS & “Budapest” Diagnostic criteria (8).

IASP Diagnostic criteria for CRPS

- The presence of an initiating noxious event or a cause of immobilization.
- Continuing pain, allodynia or hyperalgesia with which the pain is disproportionate to any inciting event.
- Evidence at some time of edema, changes in skin blood flow, or abnormal sudomotor activity in the region of pain.
- This diagnosis is excluded by the existence of conditions that would otherwise account for the degree of pain and dysfunction.
- TYPE I: Without obvious nerve damage (aka RSD).
- TYPE II: With obvious nerve damage (aka Causalgia)

Budapest” diagnostic criteria for CRPS

General Definition of the Syndrome

CRPS describes an array of painful conditions that are characterized by a continuing (spontaneous and/or evoked) regional pain that is seemingly disproportionate in the time or degree to the usual course of any known trauma or other lesion. The pain is regional (not in a specific nerve territory or dermatome), but may spread, and usually has a distal predominance of abnormal sensory, motor, sudomotor, vasomotor, and/or trophic findings. The syndrome shows variable progression over time.

To make clinical diagnosis, the following criteria must be met:

- Continuing pain, which is disproportionate to any inciting event.
- Must report at least one symptom in ‘three of the four’ following categories:
 - SENSORY: Reports of hyperalgesia and/or allodynia.
 - VASOMOTOR: Reports of temperature asymmetry and/or skin color changes and/or skin color asymmetry.
 - SUDOMOTOR/EDEMA: Reports of edema and/or sweating changes and/or sweating asymmetry.
 - MOTOR/TROPHIC: Reports of decreased range of motion and/or motor dysfunction (weakness, tremor, dystonia) and/or trophic changes (hair, nail, skin).
- Must display at least one sign at time of evaluation in two or more of the following categories:
 - SENSORY: Evidence of hyperalgesia (to pinprick) and/or allodynia (to light touch and/or deep somatic pressure and/or joint movement).
 - VASOMOTOR: Evidence of temperature asymmetry and/or skin color changes and/or skin color asymmetry.
 - SUDOMOTOR/EDEMA: Evidence of edema and/or sweating changes and/or sweating asymmetry.
 - MOTOR/TROPHIC: Evidence of decreased range of motion and/or motor dysfunction (weakness, tremor, dystonia) and/or trophic changes (hair, nail, skin).
- There is no other diagnosis that better explains the signs and symptoms.

Management requires Multimodal & Multidisciplinary approaches (6) that is: Effective pain control: (1) pharmacologic (2) interventional methods by IVRA, Sympathetic nerve blocks and Spinal cord stimulation; Functional restoration, Rehabilitation-Based Treatment Modalities, Psychologic Interventions & Other Therapeutic Modalities.

Price and colleagues found that sympathetic block with local anesthetic gives immediate relief on pain and mechanical allodynia and sympatholysis may be important in prolonging the duration of pain relief for CRPS I patients who respond to diagnostic sympathetic block. Radiofrequency thermo coagulation of sympathetic chain is provides long term pain relief in CRPS 1 and improves quality of life.

Methods

This study is done at Advance Pain Care Clinic, Surat, Gujarat, India from January 2015 to June 2015. Total 18 patients were selected who are diagnosed as CRPS 1 in one hand based on IASP-BUDAPEST criteria (8).

All these patients were initially treated with conservative trial that includes pharmacological methods plus rehabilitation for 6 weeks. The demography and etiology are given in table 1.

All 18 patients were examined and diagnosis of CRPS type 1, right side 11 and 7 left were included. 10 patients were women and 8 were men. Age of patients were between 18-85 years were included. The conditions associated with development of CRPS 1 includes lower end radius fracture, hand trauma, metacarpal fracture, soft tissue excision, carpal tunnel release and crush injury hand.

All these 18 patients with VAS >4/10 not respond to conservative management (6weeks). So, they are considered for sympathetic block. All 18 patients are assessed and then explain about the procedure. Written informed consent was taken.

We have first given diagnostic stellate ganglionic block at C7 level under fluoroscopic guidance after confirmation with omnipaque dye in OT with local anesthesia, inj xylocain 2% 2 cc plus methyl prednisolone 40 mg plus normal saline, total volume 6 ml. Those who have reduce more than 50 % pain relief for diagnostic stellate block, were given radiofrequency ablation after one week with conventional radiofrequency at 80-degree temperature for 60sec 3 under fluoroscopic guidance under local anesthesia after confirmation with sensory and motor stimulation (Group 1).

Those who fail to reduce 50 % pain score after diagnostic stellate block who's given diagnostic T2-T3 Sympathetic block after one week with inj xylocain 2% 3 cc with inj methyl prednisolone 40 mg with normal saline 6 cc, total volume 10 cc at each level. Those who reduce more than 50 % pain score after diagnostic T2-T3 sympathetic block were given radiofrequency ablation at T2-T3 sympathetic block under fluoroscopic guidance with conventional RF at 80-degree c for 60 sec 3 cycles at each level after confirmation with sensory motor stimulation. (Group 2).

Pain intensity was evaluated before and after diagnostic block using a 10cm VAS in which 0 means no pain and 10 represented most severe pain. More than 50% reduction in VAS SCORE for at least 6 hours was considered as positive diagnostic block.

Among 18 patients, 10 patients having positive stellate ganglionic block, so these patients were given Radiofrequency ablation and 8 patients had negative stellate ganglion block so these 8 patients were given T2-T3 Thoracic sympathetic diagnostic block after one week.

Among 8 patients, 4 patients having positive T2-T3 diagnostic block, so these patients were considered for Radiofrequency Ablation T2-T3 sympathetic block after 1 week.

4 patients had negative T2-T3 Sympathetic block, so these patients are considered as a sympathetic independent and these patients are excluding from the study.

All patients experienced more than 50% pain relief after RF after 2 weeks and 1 month follow up. All patients were able to decrease their oral analgesic drugs dosage more than 50% after 1 month of RF and improved range of movement of wrist joint after 1 month of RF.

No complications attributed to procedure were noted.

Inclusion criteria

- H/O trauma or surgery
- Patient had taken conservative treatment e.g. medication, physical therapy, rehabilitation
- Programmed but failed to have pain relief.

- Any age
- Any sex

Exclusion criteria

- Patients who respond to conservative management.
- Upper limb CRPS II and lower limb CRPS.
- H/O nerve injury.
- Patient having other neuropathy like DM or other.
- Patients who has not taken conservative treatment.
- False negative block.
- Use of tobacco products or any medication that could affect sympathetic function.
- Active infection at injection site.
- Allergy to medication.
- Previous neck surgeries, Reynaud’s disease or phenomenon.
- Coagulopathy.

Table 1. Patient demographic values and etiologies

No.	Age	Gender	Initial trauma	Side	Duration (weeks)
1	50	F	Carpel tunnel release	L	15
2	67	F	# Lower end radius	R	16
3	61	F	Hand trauma	R	17
4	75	M	#Lower end radius	R	17
5	58	F	Radial distal end #	R	18
6	60	F	Hand trauma	R	20
7	29	F	Soft tissue excision biopsy	L	21
8	34	M	Crush injury hand	L	22
9	73	M	Radial distal end #	R	26
10	18	F	Hand trauma	L	28
11	85	M	#Lower end radius	R	29
12	43	M	Metacarpal fracture	L	33
13	46	F	Crush injury hand	R	35
14	74	M	Lower end radius #	R	48
15	59	F	Radial distal end #	R	50
16	38	M	Soft tissue excision	L	51
17	70	F	Radial distal end #	R	52
18	27	M	Fifth metacarpal #	L	54

Results

Table 2. VAS SCORE

No.	Before block	After diagnostic SGB	After diagnostic TSB
1	6	3	-----
2	7	3	-----
3	7	2	-----
4	8	4	-----
5	8	4	-----
6	8	3	-----
7	9	4	-----
8	9	3	-----
9	10	4	-----
10	10	4	-----

11	10	7	2
12	9	6	3
13	9	6	3
14	10	8	4
15	10	7	5
16	10	10	7
17	10	9	8
18	9	9	6

Table 3. Shows Patient's Vas Score RF T2-T3 Sympathetic Block

PATEINT NO.	INITIAL VAS	2 WEEKS AFTER RF	1 MONTH AFTER RF
1	10	4	3
2	9	3	2
3	9	2	1
4	10	3	2

Table 4. Shows Analgesic (mg/day) Usages before and after T2-T3 Sympathetic Block

PATIENT NO.	TRAMADOL PRE RF	TRAMADOL POST RF	GABAPINE PRE RF	GABAPINE POST RF	AMITRIPTYLINE PRE RF	POST RF
1	100	50	300	100	25	00
2	150	50	600	200	25	10
3	150	50	400	200	25	10
4	100	50	400	200	25	00

Values VAS score pretreatment and after diagnostic block are shown in table 2. Values VAS score after RF after 2 weeks and 1 month follow up are shown table 3. Values of analgesic dosages before and after RF in both groups are shown in table 4. The blockade was significantly reduced in analgesic dosages in all patients.

Limitation

1. Comparison between Stellate Ganglion Block and T2-T3 block is not taking in study but efficacy is taken in study.
2. False positive and false negative block should not take in consideration.
3. Negative diagnostic block not take study.
4. Long term follows up more than one month is not taken study.

Discussion

CRPS is an inflammatory and neuropathic pain disorder characterized by autonomic nervous system involves sensory, motor, sudomotr and vasomotor changes

There are 3 stages of CRPS summarized by Bonica.

(I) Acute stage

Pain or sensory abnormalities hyperalgesia, allodynia, vasomotor and sudomotor dysfunctions and prominent edema.

(II) Dystrophic stage

It takes 3-6 months after onset. It is characterized by more or provoked pain or sensory dysfunction with continues evidence of vasomotor dysfunction and development of significant motor and trophic changes.

(III) Atrophic changes

It is characterized by decreased pain or sensory disturbance, cor time vasomotor disturbances and markedly increased motor or trophic changes.

As per pathophysiology, sympathetic nervous system has important role in pain and many studies shows that sympathetic blocks help to reliving pain.

Thus, interdisciplinary or multidisciplinary approaches are key for management of CRPS and that includes pain management, psychological support, and rehabilitation for restoration of function.

Conservative management includes opioids, NSAIDS, anticonvulsant drugs, antidepressant drugs, NMDA antagonist drugs, steroids with rehabilitation.

Invasive procedures include nerve blocks, Spinal cord stimulator, peripheral nerve stimulator, clinical and surgical sympathectomy and deep brain stimulator have been used to manage CRPS 1 for some time.

Conclusion

Many modes of treatment and other procedures were demonstrated to manage pain CRPS. These include nerve block, spinal cord and peripheral stimulation, chemical and surgical sympathectomy and deep brain stimulation (4). Sympathetic nervous system dysfunction is presumed to be an essential component of the syndrome (11) and among all procedures sympathetic blockage has been recommended as early as possible to interrupt and reverse the process (12). Sympathetic block treatment may be particularly helpful in such cases in which other modalities not give adequate pain relief (13).

Some study suggested that stellate ganglion may not be the most suitable target for upper limb sympathetic block in CRPS 1(14, 15, 16, and 17). This suggestion is mainly due to fact that SGB may miss the sympathetic nerve fibers travelling to the upper limb in a significant proportion of individual (18). Thus, by blocking T2-T3 sympathetic ganglion can cover all sympathetic fibers. In fact, Hogan (17) showed that in 100 consecutive technically well-performed SGB procedure monitored by papillary and hand temperature change, the clinically signs of upper limb sympathetic blockage were only detected after 27 of the procedure (17). Kuntz (18) has demonstrated that in 20% of individuals the ganglion sympathetic fibers projected to upper limb directly, thus bypassing the stellate ganglion after synapsing in the upper thoracic ganglia. This is important given the major difference between TSB and SGB.

Very few studies were assessed the effects of TSB in this patient group. In our study, 18 patients show that there is chance of inadequate pain relief after satisfactory stellate ganglion block because of KUNTZ'S nerve and giving T2-T3 sympathetic block among this gives good pain relief. Also, RF in stellate ganglion and T2-T3 sympathetic ganglion block gives long term pain relief and decrease analgesic dosages and thus improves quality of life.

We believed that TSB is a safe procedure and no major adverse events related to the blocking procedure and most minor side effects similarly distributed in both groups. Larger controlled trials are needed to confirm this initial impression.

Our data showed that TSB is a safe procedure and has both short- and long-term positive impact on upper limb CRPS 1 as an add-on treatment to a standardized rehabilitation and pharmacological treatment part.

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