PAIN MEDICINE CASE REPORTS

ISSN 2768-5152

Volume 6, Number 7, pp. 285-290

Percutaneous Peripheral Radiofrequency Ablation of Mandibular Nerve: Case Series of Seven Patients

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Background: For longer pain relief from mandibular neuralgia (MN), radiofrequency ablation (RFA) of trigeminal ganglion is undertaken intracranially and fluoroscopically.

Objectives: For better safety, extracranial peripheral percutaneous mandibular nerve block (EPPMNB) has been tried; however, to the best of our knowledge, no such large series is published.

Study Design: Seven patients of MN were enrolled for EPPMNB.

Settings: Pain Outpatient Department (OPD)

Methods: Seven patients of MN underwent EPPMNB.

Results: EPPMNB can be safely undertaken in OPD with low risk of complications and is efficacious for long-term treatment for MN.

Limitations: Further randomized controlled trials are required for definitive conclusions.

Conclusions: EPPMNB with RFA is safe and effective for MN.

Key words: Mandibular neuralgia, radiofrequency ablation, trigeminal ganglion

BACKGROUND

Trigeminal neuralgia (TN) has an incidence of 4-5/100,000 with 15% patients of mandibular neuralgia (MN). MN is a debilitating illness chiefly managed with medical drugs; however, 10% patients do not respond to this treatment (1,2). For longer pain relief from MN, radiofrequency ablation (RFA) and chemical neurolysis (CN) of trigeminal ganglion (TG) is undertaken of which RFA has shown better results (1).

TG block for MN is performed under fluoroscopic guidance wherein a needle is inserted intracranially via the foramen ovale (FO) to approach inferior region of TG (3). This procedure requires a special block area, and has radiation hazards with reported complications due to intracranial approach (4). To eliminate these setbacks, extracranial peripheral percutaneous mandibular nerve (V3) block (EPPMNB) has been undertaken wherein a needle is inserted through mandibular notch directed inferoposterior to the pterygoid plate and identification of V3 is done by either paraesthesia or in recent years by mandibular jerk with a peripheral nerve stimulation (PNS) needle (2). However, data is scarce.

In the present paper, retrospective data of 7 patients of MN who underwent EPPMNB with RFA is discussed.

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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.
Patient consent for publication: Consent obtained directly from patient(s).
Accepted: 2022-07-26, Published: 2022-11-30

To the best of our knowledge, this is the largest such case series.

Methodology

All 7 patients underwent EPPMNB in the outpatient department (OPD) with available equipment for resuscitation. Patients were made to lie supine with head in the neutral plane. Standard monitors of pulse oximetry, electrocardiography, and noninvasive blood pressure were attached and monitored throughout the procedure. The baseline Numeric Rating Scale (NRS-11) was noted. Target area was cleaned with a chlorhexidine spray and under all aseptic precautions, the sigmoid notch was identified by asking the patient to open and close the mouth. Local anesthesia was given with 1 mL of 2% lignocaine. A 20-G 10-cm RF needle (Cosman®, Cosman Medical, Inc., Burlington, MA) was inserted in a perpendicular plane till contact with pterygoid plate was made. After contact with the lateral pterygoid surface, the needle was pulled back and redirected in a postero-inferior direction behind the lateral pterygoid plane for 1-2 mm. The RF probe (Cosman®, Cosman Medical, Inc., Burlington, MA) was then attached to the needle and sensory and motor stimulation was done. A confirmatory test of sensory stimulation was elicitation of concordant pain in the same distribution at 50 Hz at 1 V and confirmation of motor stimulation was jaw jerk at frequency of 2 Hz at 1 mA. After obtaining positive response with both sensory and motor stimulation, 1 mL of 2% lignocaine was injected and after one minute, RF or pulsed radiofrequency (PRF) (Cosman®, Cosman Medical, Inc., Burlington, MA) was done (Table 1). Postprocedure, patients were kept under observation for one hour. All patients were followed up for 3 months and NRS-11 scores were noted (Table 1).

RESULTS

This case series includes 7 patients given RFA with EPPMNB (Table 1). Age range was from 49-77 years with 2 women and 5 men. All patients had NRS-11 score of 8-9/10 on initial presentation with duration ranging from 3 months to 11 years.

Case 1

A 51-year-old woman with left MN of 11 years received multiple EPPMNB with phenol and steroids. Presently, single cycle of continuous radiofrequency (CRF) at 80°C for 90 seconds was given, which failed to provide long-term pain relief (NRS-11 8/10 at one month). EPPMNB CRF was repeated with 3 cycles at 70°C for 90 seconds, which reduced NRS-11 to < 3/10 for 3 months. Pain recurred at 3 months (NRS-11 8-9/10) for which TG RFA was undertaken resulting in NRS-11 0-1 sustained for last 11 months.

Case 2

A 70-year-old male with right MN of 10 years previously received EPPMNB with multiple phenol and steroid injections. Presently, he was given 2 cycles of CRF at 70°C for 60 seconds, which failed to achieve adequate pain relief. CRF was repeated with 3 cycles at 70°C for 90 seconds, which resulted in pain relief (NRS-11 to < 3/10) at one week sustained for last 12 months.

Case 3

A 77-year-old male on medical management of left MN of 4 months duration was given 3 cycles of EPPMNB CRF at 70°C for 90 seconds, which resulted in significant pain reduction (NRS-11 2/10) sustained for last 4 months.

Case 4

A 70-year-old male with right MN of 3 months duration on medical management was given 3 cycles of EPPMNB CRF at 70°C for 90 seconds with significant pain reduction (NRS-11 0-1) resulting in discontinuation of oral medication for last 5 months.

Case 5

A 64-year-old male with left MN of 3 years duration with single phenol injection one year back presented with NRS-11 8/10 and was given 3 cycles of EPPMNB CRF at 60°C for 90 seconds. NRS-11 was 6/10 at the end of first week and 3-4/10 at end of 3 weeks sustained for last 3 months.

Case 6

A 49-year-old woman with left MN of 3 years was given 3 cycles of EPPMNB CRF with first cycle at 60°C for 60 seconds and successive 2 cycles at 65°C for 60 seconds. However, there was no pain relief. After a month, combination of one cycle of PRF at 42°C for 600 seconds followed by one cycle of CRF at 65°C for 180 seconds was given which again failed to relieve her pain. On diagnostic workup, magnetic resonance imaging revealed compression of TG by post-inferior cerebellar artery. Surgical follow-up was advised.

Table 1. Details of patients and treatment.

Sno	Age/ Gender	Diagnosis	Duration	Prev Injection	Date	RFA	Pre-proc NRS-11	Post-proc NRS-11					Medications (per day)	
								1 wk	2 wk	1 mo	2 mo	3 mo	Pre-proc	Post-proc
1	51/W	LV3 TN	11 y	Phenol/ steroid multiple times	6/25/21	CRF 80°C×90s × 1 cy	10	8	8	8			CBZ 600 mg PGB 150 mg Baclofen 30 mg	CBZ 200 mg
					7/23/21	CRF 70°C× 90s × 3 cy	8	2	2	2	4	4		
					12/23/21	TG RFA**	7	2	1	1	1	1		CBZ 100 mg
2	70/M	RV3 TN	10 y	Phenol/ steroid multiple times	7/2/21	CRF 70°C×60s × 2 cy	9	8	9				CBZ 1200 mg, PGB 150 mg	CBZ 200 mg
					7/23/21	CRF 70°C×90s × 3 cy	9	2	2	2	1	1		Nil
3	77/M	LV3 TN	4 mo	None	7/16/21	CRF 70°C×90s × 3 cy	10	3	2	1	1	1	CBZ 900 mg, PGB 75 mg Baclofen 10 mg	Nil
4	70/M	RV3 TN	3 mo	None	7/28/21	CRF 70°C×90s × 3 cy	10	2	0-1	0-1	0-1	0-1	CBZ 600 mg, PGB 75 mg Baclofen 5 mg	Nil
5	64/M	LV3 TN	3 y	Phenol Once	8/6/21	CRF 60°C×90s × 3 cy	10	6	3-4	3-4	3-4	3-4	CBZ 600 mg, PGB 150 mg Baclofen 10 mg	CBZ 400 mg
6	*49/W	L.V3 TN	3 y	None	8/13/21	CRF 60°C×60s × 1 cy CRF 65°C×60s × 2 cy	10	8	7	8			CBZ 600 mg, PGB 150 mg Baclofen 10 mg	CBZ 1000 mg Amitriptyline 10 mg Tramadol 100 mg
					9/10/21	PRF 42°C×600s × 1 cy CRF 65°C×180s × 1 cy	8	7	8	8	8	8	MRI post-inferior cerebellar artery at TG	
7	60/M	LV3 TN	6 mo	None	9/10/21	PRF 42°C×600s × 1 cy CRF 65°C×180s × 1 cy	9	3	2	2	2	2	CBZ 600 mg, PGB 150 mg Baclofen 10 mg	CBZ 200 mg

*After minimal relief with RFA, MRI revealed post-inferior cerebellar artery at TG.
** Patient had previous multiple phenol injections for MN.
Abbreviations: Prev: Previous/PRF: Pulsed Radiofrequency/CBZ: Carbamazepine/PGB: Pregabalin/M: Man/W: Woman/cy: cycle/s: second/NRS-11: Numeric Rating Scale//CRF: Continuous Radiofrequency/TG: Trigeminal Ganglion/TN: Trigeminal Neuralgia/mo: month/wk: week/RFA: Radiofrequency Ablation/Pre proc: Pre-procedure/y: year/MRI: Magnetic Resonance Imaging/V3: Mandibular Nerve/L: Left/R: Right/ MN: Mandibular Neuralgia.

Case 7

A 60-year-old male with left MN of 6 months duration on medical management, underwent one cycle of PRF at 42°C for 600 seconds followed by one cycle of CRF at 65°C for 180 seconds following which significant pain relief was seen (NRS-11 2/10) for last 4 months with continuation of oral medications.

DISCUSSION

TN is defined as "recurrent paroxysms of unilateral facial pain in the distribution(s) of one or more divisions of the trigeminal nerve, with no radiation beyond, lasting from a fraction of a second to 2 minutes, severe intensity, electric shock-like, shooting, stabbing or sharp in quality, precipitated by innocuous stimuli within the affected trigeminal distribution [and] not better accounted for by another diagnosis" (5).

TG has 3 branches of ophthalmic (V1), maxillary (V2), and V3. Distribution of pain in TN is maximum in combination of V2 and V3 divisions (32%), followed by V2 division (17%), V3 division (15%), and 4% in V1 (6).

TN causes severe disability impacting daily work. It is commonly treated with antiepileptic drugs, such as carbamazepine; however, up to 10% patients do not respond to medical therapy and require interventions, which includes microvascular decompression, gamma knife radiosurgery, and percutaneous techniques like balloon compression, RFA, or CN (glycerol rhizotomy) of TG (7). TG is blocked intracranially via FO with needle targeting the inferior part of the ganglion for MN. Reported complications of the procedure include transient depressor response of bradycardia and hypotension requiring atropine or transcutaneous pacing and higher risk of severe neurological complications like intracranial hemorrhage, infection, and injection into the subarachnoid space. Procedures on TG are done under fluoroscopy or computed tomography (CT)-scan guidance in a special block area, have radiation hazards, and are less selective of individual branches (4,8). Thus, in recent years, extracranial localization of V3 without fluoroscopic or CT-scan guidance has been explored. This is traditionally done by inserting a needle through the mandibular notch, hitting the pterygoid plate, and then redirecting the needle inferoposteriorly toward V3 to elicit paraesthesia. However, this might not be accurate due to subjective reporting by the patient and is frequently difficult to elicit with previous multiple injections of neurolytic agents (9).

V3 is a mixed division of TG with small anterior trunk which supplies the muscle of mastication and large posterior trunk which supply sensory innervation to the floor of mouth, anterior two-thirds of the tongue and lower jaw. Recently, V3 was localized with motor stimulation by PNS to visualize jaw jerk (2). In the present series, both motor and sensory stimulation were used with the RF needle to localize MN. Sensory stimulation simulated pain distribution of patient and motor stimulation further confirmed MN with jaw jerk.

Blockade of V3 is done either by injection of local anesthetics or neurolytic agents like alcohol, phenol, and glycerol for long-term relief. However, neurolytic agents for nonmalignant pain is controversial due to uncontrolled spread and nonspecific destruction of all nerve fiber types. Thus, for nonmalignant pain, modalities like RFA have become popular. CRF spares myelinated fibers and only destroys the unmyelinated and poorly myelinated nociceptive nerve fibers. Heating up to 70°C to 75°C leads to degeneration of nonmyelinated nociceptive fibers of the trigeminal nerve (A delta and C fibers), sparing myelinated fibers (A alpha and A beta fibers), which tolerate a higher temperature (10). Lesion size of CRF depends on various factors like tip gauge, tip length, temperature, and time (10). PRF at short bursts of current at 42°C produces neuromodulation with which leads to microscopic damage to axonal microfilaments and microtubules with more changes in C-fibers (4).

For MN, most reports on RFA are small cases with short follow-ups, performed via FO approach with either CT or fluoroscopy, not targeting peripheral nerve branches (1,3,11-15) (Table 2). CT-guided RFA at FO was performed in 11 patients at 70°C for single cycles of 60 to 90 seconds or 90°C for 90-180 seconds (11). A study of 1,354 patients on CT-guided RFA for V2/V3 of TN deduced single cycle of RFA at 68°C for 180 seconds to be optimal (16). RFA at 68°C for 180 seconds for V2, V3, and V2+V3 found pain relief at 75°C to be marginally higher than at 68°C, but higher incidence and severity of complications at 75°C resulted in higher patient satisfaction at 68°C (17). Comparison of PRF, RF, and combined PRF+ RF of Gasserian ganglion concluded best results with combined approach (13) (Table 2).

In the present series, combination of CRF and PRF was given to case 7, which resulted in significant decrease in the NRS-11 score, but oral medications could not be decreased. Effective pain relief along with decrease or cessation of oral medications was seen after 3 cycles of 90 seconds of CRF at 70°C in cases 3 and 4. CRF of < 3 cycles or temperature < 70°C or duration of cycles < 90

Table 2. Previous studies of RFA of TG at FO for Mandibular Neuralgia.

	Year	Author	No of Pts	RFA	Needle Guidance	Pain NRS-11			Result
						Pre-treatment	1 Mo	3-12 Mo	
1	2010	Koizuka et al (11)	11	CRF 70-90°C for 90-180s	CT & PNS	6.5 ± 1.8	1.8 ± 1.7	0.9 ± 1.0 (3 mo)	Medications reduced in 3 mo
2	2013	Bovaira et al (14)	5	CRF 60-65-70°C 60s 3 cyc	Fl & PNS	>7/10	2-4/10	0-2/10	Recurrence at 21 mo in one patient/ Studied up to 24 mo
3	2017	Elawamy et al (13)	11	PRF 42°C for 10 min	Fl & PNS	8.67 ± 2.53	1.33 ± 0.27	0.255 ± 0.07	Studied up to 24 mo with > 90% patient satisfaction
			12	CRF 75°C for 270s		9.00 ± 0.89	0.636 ± 0.9	1.18 ± 0.17	
			20	PRF 42°C 10 min CRF 60°C for 270s		9.15 ± 1.13	0.255 ± 0.07	0 (12 mo)	
4	2019	Bharati et al (12)	NS	CRF 70°C 60s 3 cyc	PNS	7.5 (7-8)	3 (1.25-3)	3 (1-3) 3 mo	Poor relief in 2 pts at 3 mo
5	2019	Huang et al (1)	26	CRF 90°C for 90s	CT & PNS	NS	Pain relief 100%	Pain relief 100%	Studied up to 27 mo, recurrence in 1 pt in monopolar RF group
6	2021	Lin et al (3)	107	CRF 90°C for 120s	CT & PNS	NS	Complete pain relief	Complete pain relief	Studied up to 24 mo, recurrence after 7-23 mo in 9 pts

Abbreviation: RFA: Radiofrequency Ablation/TG: Trigeminal Ganglion/MN: Mandibular Neuralgia/NS: Not specified (no pain score specified)/CRF: Continuous Radiofrequency/CT: Computed Tomography/PRF: Pulsed Radiofrequency/min: minute/Fl: Fluoroscopy/PNS: Peripheral Nerve Stimulation/mo: month/pts: patients/ NRS-11, Numeric Rating Scale/s: second/cy: cycle.

seconds or previous invasive treatments (cases 1, 2, and 5) did not result in NRS-11 < 3 or decrease or cessation of oral medications (Table 1). In a review, temperature settings of 65°C to 70°C for CRF of TG was found effective to control pain and decrease the probability of adverse reactions in patients with maxillary neuralgia or MN (4). The present series includes patients of MN with variable previous treatments, thus making it difficult to draw conclusions on best parameters of RFA.

No previous study to the best of our knowledge has documented EPPMNB RFA in a large series of 7 patients. Bharati et al (12) documented RFA of TG to be as effective as CRF of peripheral branches of Gasserion ganglion when performed in 20 patients at 70°C for 3 cycles of 60 seconds (Table 2). However, in this study, data included blocks at either supraorbital foramen, infraorbital foramen, mandibular notch, or mental foramen and did not specify the number of patients of MN.

EPPMNB RFA has the potential of lesser complications due to extracranial procedure, devoid of radiation hazards, wider use, and longer pain relief. Also localization by both sensory and motor stimulation ensures correct location of needle. Further randomized trials are recommended to come to a definite conclusion.

CONCLUSIONS

EPPMNB can be safely undertaken in OPD with low risk of complications and is efficacious for long-term treatment for MN. Further randomized controlled trials to determine optimal RFA settings are recommended.

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