



Radiofrequency for Treatment of Head and Neck Neurology Pain

Armin Modarresi Esfe, MD^a; Mahsa Fadei, MD**^b

^aMD, Ahvaz Jundishapur Medical University, Email: arminmodarresi@yahoo.com

^bMD, Ahvaz Jundishapur Medical University, Email: dr.mahsafadaei@gmail.com

ABSTRACT

Radiofrequency Ablation (RFA) technology has been used to ablate or modify unpleasant sources. RF has been utilized to treat a variety of pain-producing components for more than 50 years, although not all pain syndromes have yet been treated with it due to knowledge or technical limitations. In this review paper, we'll look at how RFA is being used in pain management for the first time and how it's trending and might be used in the future. They include:

- Chronic headaches, Migraines, Cluster, Atypical facial pain, Postherpetic neuralgia, Head and neck cancer pain, Postoperative headaches, Posttraumatic headache, Sluder's neuralgia, Cervicogenic Headaches, Tinnitus
- Trigeminal neuralgia (Typical- Atypical- Post-traumatic), Glossopharyngeal Neuralgia, Supraorbital Neuralgia, Infraorbital Neuralgia, Facial pain secondary to tumor removal

Keywords: Radiofrequency, Head and Neck, Neurology, Pain

1. Main text

Introduction: Radiofrequency Ablation (RFA) technology has been used to ablate or modify unpleasant sources. RF has been utilized to treat a variety of pain-producing components for more than 50 years, although not all pain syndromes have yet been treated with it due to knowledge or technical limitations. This review paper will look at how RFA is being used in pain management for the first time, how it's trending, and how it might be used in the future. RF's collaborative uses, better technology, and safety characteristics in pain therapy will also be explored as the new indications(1).

Headache Pain Syndromes: Headaches are a significant source of discomfort, disability, and social isolation. Learning that specific sensory nerves contribute to the patient's headache allows for a minimally invasive ablation for the discerning clinician. This improves daily function and reduces the need for medication for many patients.

SPG was previously targeted using RF thermocoagulation. The sphenopalatine branch of the maxillary nerve was permanently damaged in these approaches, resulting in permanent cheek and palate numbness. (2). The SPG uses pulsed RF technology, which is less damaging and causes minor discomfort during treatment (3, 4).

Using fluoroscopy and computed tomography, needles can be positioned in the SPG using the percutaneous infra zygomatic technique. (5).

Atypical face pain, SPG neuralgia caused by herpes zoster, and atypical trigeminal neuralgia can be treated with PRF-SPG. PRF-SPG was used using the Infrazygomatic approach and Fluoroscopy guidance in the above disorders. Thirty-five percent of patients had complete pain reduction, and 42 percent had moderate relief (2). 30 patients with chronic pain in the head and face were treated with SPG-PRF, and 21% experienced complete pain alleviation, while 65% experienced moderate improvement (6)

* Corresponding author: Armin Modarresi Esfe
E-mail address: arminmodarresi@yahoo.com

Cluster headaches (CH): one of the most common headaches, can also be treated with RF. There are two types of cluster headaches: those that occur frequently and those that occur infrequently. Flushing, lacrimation, nosebleeds, and redness of the face are all signs of eye and nose dysfunction. (7). Targeting the SPG with CT-guided PRF can be used to treat refractory cluster headaches. Most patients with refractory episodic CH were shown to have effective remission, while only 64% of those with chronic CH showed the same results (4).

Cervicogenic Headaches (CHA): The higher cervical spine sources a secondary headache (8). The efficacy of RFA or PRF in CHA cases refractory to medication therapy has been evaluated in numerous case reports and retrospective investigations (9, 10).

The DRG of C2 and C3 have recently been targeted for CHA, which has resulted in satisfactory outcomes. (11), either by applying pulsed RF to the greater occipital nerve and the left atlantoaxial joint region, which produced positive outcomes (12).

C1-2 intra-articular joint ablation is a new treatment for CHA. The therapeutic purpose of intra-articular Treatment and RF neurotomy differs. Intra-articular joint ablation relieves pain by stimulating articular cartilage or joint capsule sensory fibers. Instead, it targets the medial nerve branches that feed the facet joints. The C1-C2 joint ablation caused a temporary increase in discomfort, but functional improvements were realized (13). Some rheumatological diseases can present them in different conditions, such as Ankylosing spondylitis (14).

Glossopharyngeal Neuralgia (GPN) Pain attacks in the sensory distribution of the glossopharyngeal nerve are a symptom of this rare facial pain disease (cranial nerve IX) (15). GPN is best treated with medical intervention (16), but Rhizotomy, a nerve block, microvascular decompression, and other treatments have been tested.

Even though percutaneous RF thermocoagulation may effectively treat idiopathic and secondary GPN, Treatment comes with several risks and side effects.(17). Therefore, PRF has been used in various studies to treat GPN and has had less negative effects. Treatment for idiopathic glossopharyngeal neuralgia with CT-guided pulsed RF was studied for its long-term impact on patient outcomes. Their one-month success rate was 93.3 percent, and their long-term recurrence-free survival rates at 120 months postoperatively were 54.8 percent(18).

The glossopharyngeal nerve is percutaneously rhizotomies through the JF using a lateral cervical route. The vagus nerve, spinal accessory nerve, and internal carotid artery can be damaged. The use of fluoroscopic C-Arm and CT-guided selective RF ablation for trigeminal and glossopharyngeal facial pain disorders was novel. To block the V3 branch, the V2 branch, and the glossopharyngeal nerve, researchers used flat-panel C-arm CT guidance in a 2018 publication. This technique helped 18 individuals with TN, GPN, and unusual facial discomfort. Achieved 100% technical success using needle guidance, notably in difficult-to-reach locations like the styloid process and foramen rotundum. A good therapeutic response was achieved with minimal adverse effects (19)

Supraorbital Neuralgia: In this rare neuropathy, the forehead's supraorbital notch and medial part are painful. The supraorbital nerve is a frontal sensory branch. Drugs and supraorbital nerve blocks may help. Supraorbital neuralgia has been treated with neurodestructive (RF thermocoagulation) and non-destructive (PRF). (20).

Patients with refractory supraorbital neuralgia were treated with ultrasound-guided RF thermocoagulation for a year. It was 96.2% at 12 months and 49.7% at 97 months (21).

Infraorbital Nerve Neuralgia: This neuralgia was treated with RF at 42°C percutaneous nondestructive method (PRF) (22). High voltage PRF recently proved safe and beneficial for refractory infraorbital nerve neuralgia. (23). For patients who did not react to standard therapy, 42°C PRF combined with 60°C CRF was employed, with a 72.7 percent efficacy rate over two years (24).

Contraindications: Radiofrequency ablation has few contraindications. Contraindications include patient refusal, high ICP, and local infection. Because many procedures involve the spinal column, good clinical judgment and standard of care are required when dealing with anticoagulants and bleeding disorders. It is usually done following ASRA rules. When to discontinue taking aspirin (6 days), clopidogrel (7 days), apixaban (3-5 days), rivaroxaban (3 days), warfarin (5 days), and intravenous heparin (4 hours). Coagulation studies should be evaluated as needed. Bacteremia and congenital or surgical anomalies are relative contraindications. Because these are elective operations, weighing risks and benefits is critical.

Trigeminal neuralgia (TN): Attacks in the distribution path of one or more branches of the trigeminal nerve that are sudden, frequent, fleeting, sharp to stabbing in nature present themselves. (25). RF can be used to treat TN resistant to other treatments. Under CT guidance, individual branches at the existing foramen are safer and more selective than the intracranial Gasserian Ganglion (GG). Percutaneous transforaminalovale (FO) targeting the GG is the most prevalent method. (26, 27). RF can also be used in some orthopedic conditions. Some orthopedic conditions don't need surgery, so an alternative plan should be considered (28).

Posttraumatic trigeminal neuropathy (PTTN): is a result of damage to the trigeminal nerve's peripheral branches. Under a lateral fluoroscopic approach, PTTN patients who received PRF of the SCG experienced decreased pain from 8.82 to 3.94 (29).

Chronic headaches, especially chronic migraines, can be treated with RF. RF ablation for pericranial nerves relieved pain in 90.3 percent of patients, and the mean pain score decreased from 6.6 to 1.9 (30). Common medicines don't help some migraines, and they can be controlled with PRF stimulation of the greater occipital nerve (GON). For at least three months, this method cut the pain score from 8 to 3 (31).

The sphenopalatine ganglion (SPG), also known as the pterygopalatine ganglion, is in the pterygopalatine fossa. It helps the body move. The SPG is the largest ganglion outside of the calvarium. It has sympathetic, parasympathetic, and sensory neurons in it and other cells. (32). Several types of headaches can be alleviated by focusing on SPG. Atypical face pain, cluster and migraine headaches, and trigeminal neuralgia are a few examples (33, 34).

Postherpetic neuralgia, head and neck cancer pain, and postoperative headaches following endoscopic sinus surgery have also been explored for the blocking and ablation of the SPG (35, 36)

Conclusion: In this review paper, we'll look at how RFA is being used in pain management for the first time and how it's trending and how it might be used in the future (37). They include:

- Chronic headaches, Migraines, Cluster, Atypical facial pain, Postherpetic neuralgia, Head and neck cancer pain, Postoperative headaches, Posttraumatic headache, Sluder's neuralgia, Cervicogenic Headaches, Tinnitus
- Trigeminal neuralgia (Typical- Atypical- Post-traumatic), Glossopharyngeal Neuralgia, Supraorbital Neuralgia, Infraorbital Neuralgia, Facial pain secondary to tumor removal

REFERENCES

1. Vahedifard F, Malinowski M, Chakravarthy K. Mechanism of Action of Radiofrequency Ablation. In: Deer TR, Azeem N, editors. Essentials of Radiofrequency Ablation of the Spine and Joints. Cham: Springer International Publishing; 2021. p. 7-29.
2. Tolba R, Weiss AL, Denis DJ. Sphenopalatine Ganglion Block and Radiofrequency Ablation: Technical Notes and Efficacy. *Ochsner J.* 2019;19(1):32-7.
3. Salgado-López L, de Quintana-Schmidt C, Belvis Nieto R, Roig Arnall C, Rodríguez Rodríguez R, Álvarez Holzapfel MJ, et al. Efficacy of Sphenopalatine Ganglion Radiofrequency in Refractory Chronic Cluster Headache. *World Neurosurg.* 2019;122:e262-e9.
4. Chen Z, Ren H, Zhao C, Luo F. Long-term Outcomes of Computerized Tomography-Guided Sphenopalatine Ganglion-Targeted Pulsed Radiofrequency for Refractory Cluster Headache. *Pain Pract.* 2020;20(3):289-96.
5. Vallejo R, Benyamin R, Yousuf N, Kramer J. Computed tomography-enhanced sphenopalatine ganglion blockade. *Pain Pract.* 2007;7(1):44-6.
6. Bayer E, Racz GB, Miles D, Heavner J. Sphenopalatine ganglion pulsed radiofrequency treatment in 30 patients suffering from chronic face and head pain. *Pain Pract.* 2005;5(3):223-7.
7. The International Classification of Headache Disorders, 3rd edition (beta version). *Cephalalgia.* 2013;33(9):629-808.
8. Bogduk N, Govind J. Cervicogenic headache: an assessment of the evidence on clinical diagnosis, invasive tests, and treatment. *Lancet Neurol.* 2009;8(10):959-68.
9. Grandhi RK, Kaye AD, Abd-Elsayed A. Systematic Review of Radiofrequency Ablation and Pulsed Radiofrequency for Management of Cervicogenic Headaches. *Curr Pain Headache Rep.* 2018;22(3):18.
10. Stovner LJ, Kolstad F, Helde G. Radiofrequency denervation of facet joints C2-C6 in cervicogenic headache: a randomized, double-blind, sham-controlled study. *Cephalalgia.* 2004;24(10):821-30.
11. Bovaira M, Peñarrocha M, Peñarrocha M, Calvo A, Jiménez A, March R. Radiofrequency treatment of cervicogenic headache. *Med Oral Patol Oral Cir Bucal.* 2013;18(2):e293-7.
12. Cosman ER, Jr., Dolensky JR, Hoffman RA. Factors that affect radiofrequency heat lesion size. *Pain Med.* 2014;15(12):2020-36.
13. Odonkor CA, Tang T, Taftian D, Chhatre A. Bilateral Intra-Articular Radiofrequency Ablation for Cervicogenic Headache. *Case Rep Anesthesiol.* 2017;2017:1483279.
14. Mortezaazadeh M, Vahedifard F, Ahmadi-Renani S, Salimzadeh A. A woman with a bamboo spine in the thoracic vertebra and normal sacroiliac joint; a 5-years undiagnosed ankylosing spondylitis: Case report and literature review. *Rheumatology Research.* 2020;5(1):33-8.
15. Olesen J. International Classification of Headache Disorders. *Lancet Neurol.* 2018;17(5):396-7.
16. Emril DR, Ho KY. Treatment of trigeminal neuralgia: role of radiofrequency ablation. *J Pain Res.* 2010;3:249-54.
17. Tang YZ, Wu BS, Yang LQ, Yue JN, He LL, Li N, et al. The Long-Term Effective Rate of Different Branches of Idiopathic Trigeminal Neuralgia After Single Radiofrequency Thermocoagulation: A Cohort Study. *Medicine (Baltimore).* 2015;94(45):e1994.
18. Ghaznavi A, AFRASIABI A, Vahedi fard F. Treatment for Brachymetatarsia of the Fourth Ray via Lengthening Over the Pin: A Case Series. *IRANIAN JOURNAL OF ORTHOPAEDIC SURGERY.* 2019;17(3 (66) #d00134):-.
19. Carcamo CR, Hormazabal FA, Gutierrez FI, Carmona AP. Pulsed radiofrequency of superior cervical ganglion for treatment of painful post-traumatic trigeminal neuropathy (PTTN): A case series report. *Cranio.* 2019:1-8.
20. Franzini A, Messina G, Franzini A, Marchetti M, Ferroli P, Fariselli L, et al. Treatments of glossopharyngeal neuralgia: towards standard procedures. *Neurol Sci.* 2017;38(Suppl 1):51-5.
21. Reddy GD, Viswanathan A. Trigeminal and glossopharyngeal neuralgia. *Neurol Clin.* 2014;32(2):539-52.
22. Song L, He L, Pei Q, Peng K, Wang N, Guo Z, et al. CT-guided percutaneous radiofrequency thermocoagulation for glossopharyngeal neuralgia: A retrospective clinical study of 117 cases. *Clin Neurol Neurosurg.* 2019;178:42-5.
23. Jia Y, Shrestha N, Wang X, Wang T, Luo F. The Long-Term Outcome of CT-Guided Pulsed Radiofrequency in the Treatment of Idiopathic Glossopharyngeal Neuralgia: A Retrospective Multi-Center Case Series. *J Pain Res.* 2020;13:2093-102.
24. Telischak NA, Heit JJ, Campos LW, Choudhri OA, Do HM, Qian X. Fluoroscopic C-Arm and CT-Guided Selective Radiofrequency Ablation

for Trigeminal and Glossopharyngeal Facial Pain Syndromes. *Pain Med.* 2018;19(1):130-41.

25. Luo F, Lu J, Ji N. Treatment of Refractory Idiopathic Supraorbital Neuralgia Using Percutaneous Pulsed Radiofrequency. *Pain Pract.* 2018;18(7):871-8.
26. Ren H, Shen Y, Luo F. Treatment of Supraorbital Neuralgia Using Ultrasound-Guided Radiofrequency Thermocoagulation of the Supraorbital Nerve: A Retrospective Study. *J Pain Res.* 2020;13:251-9.
27. Luo F, Lu J, Shen Y, Meng L, Wang T, Ji N. Effectiveness and Safety of Pulsed Radiofrequency Treatment Guided by Computed Tomography for Refractory Neuralgia of Infraorbital Nerve: A Pilot Study. *Pain Physician.* 2015;18(5):E795-804.
28. Luo F, Wang T, Shen Y, Meng L, Lu J, Ji N. High Voltage Pulsed Radiofrequency for the Treatment of Refractory Neuralgia of the Infraorbital Nerve: A Prospective Double-Blinded Randomized Controlled Study. *Pain Physician.* 2017;20(4):271-9.
29. Jia Y, Chen Z, Ren H, Luo F. The Effectiveness and Safety of 42°C Pulsed Radiofrequency Combined with 60°C Continuous Radiofrequency for Refractory Infraorbital Neuralgia: A Prospective Study. *Pain Physician.* 2019;22(3):E171-e9.
30. Abd-Elseyed A, Kreuger L, Wheeler S, Robillard J, Seeger S, Dulli D. Radiofrequency Ablation of Pericranial Nerves for Treating Headache Conditions: A Promising Option for Patients. *The Ochsner journal.* 2018;18(1):59-62.
31. Kwak S, Chang MC. Management of refractory chronic migraine using ultrasound-guided pulsed radiofrequency of greater occipital nerve: Two case reports. *Medicine (Baltimore).* 2018;97(45):e13127.
32. Láinez MJ, Puche M, Garcia A, Gascón F. Sphenopalatine ganglion stimulation for the treatment of cluster headache. *Ther Adv Neurol Disord.* 2014;7(3):162-8.
33. Ho KWD, Przkora R, Kumar S. Sphenopalatine ganglion: block, radiofrequency ablation and neurostimulation - a systematic review. *J Headache Pain.* 2017;18(1):118.
34. Narouze SN. Role of sphenopalatine ganglion neuroablation in the management of cluster headache. *Curr Pain Headache Rep.* 2010;14(2):160-3.
35. Zanella S, Buccelletti F, Franceschi F, Vassiliadis A, Ramponi C, Sivoletta S, et al. Transnasal sphenopalatine ganglion blockade for acute facial pain: a prospective randomized case-control study. *Eur Rev Med Pharmacol Sci.* 2018;22(1):210-6.
36. Narouze S, Kapural L, Casanova J, Mekhail N. Sphenopalatine ganglion radiofrequency ablation for the management of chronic cluster headache. *Headache.* 2009;49(4):571-7.
37. Chakravarthy K, Golovac S, Vahedifard F. Future Indications. In: Deer TR, Azeem N, editors. *Essentials of Radiofrequency Ablation of the Spine and Joints.* Cham: Springer International Publishing; 2021. p. 241-81.