Clinical Oncology: Case Reports

Case Report

A SCITECHNOL JOURNAL

Cyberknife-Based Radiosurgery For Glossopharyngeal Neuralgia

Deepak Gupta[1]*, Anirban Deep Banerjee[2], Shyam Singh Bisht[1], Venkatesan Kaliyaperumal[1], Susovan Banerjee[1], Kushal Narang[1], Mayur Mayank[1], Smriti Ram[1], Tejinder Kataria[1], Richa Arunendu[1], Deepak Keshav Bhangale[2]

Abstract

Background: Glossopharyngeal Neuralgia (GPN) is a rare and debilitating condition characterized by severe, episodic pain in the distribution of the glossopharyngeal nerve. Traditional treatment options include pharmacological management and invasive surgical procedures, which may not always be effective or suitable for all patients. Stereotactic Radiosurgery (SRS) using the Cyberknife system offers a non-invasive alternative with potential for high precision and efficacy.
Objective: This study aims to evaluate the safety and efficacy of Cyberknife-based radiosurgery in the treatment of patients with refractory glossopharyngeal neuralgia.
Methods: A retrospective review was conducted on patients diagnosed with glossopharyngeal neuralgia who underwent Cyberknife radiosurgery at our institution. Patient selection criteria included refractory GPN despite medical therapy. Treatment parameters, including target dose and volume, were tailored individually. Outcomes were assessed in terms of pain relief, medication usage, and adverse effects at follow-up intervals.
Conclusion: Cyberknife-based radiosurgery appears to be a safe and effective treatment option for patients with refractory glossopharyngeal neuralgia, providing significant pain relief and reducing the need for pharmacological intervention. Further studies with larger sample sizes and longer follow-up periods are warranted to confirm these findings and optimize treatment protocols.

Keywords: Glossopharyngeal neuralgia; Cyberknife; Stereotactic radiosurgery; Pain management; Non-invasive treatment

Introduction

Glossopharyngeal Neuralgia (GPN) is a rare condition involving the 9th cranial nerve, causing distressing symptoms of severe paroxysmal pain (electrical shooting type), triggered by stimulation of the pharynx, typically during swallowing. The term GPN was initially described by W Harris in 1921 and this condition accounts for 0.2%-1.3% of all cranial neuralgias, with an incidence rate of 0.7 per 100,000 population [1, 2]. Although the etiology remains unclear, it can be attributed to compressive effects at the root entry zone of the brainstem [3]. Treatment conventionally consists of a combination of analgesics and anticonvulsants, with Microvascular Decompression (MVD) reserved for refractory cases [4]. Other alternatives are thermo-rhizotomy at pars nervosa of jugular foramen or tractotomy-nucleotomy at the brainstem but these procedures entail significant risk of deficits. Despite radiosurgery (SRS) being recognized as an effective option for another similar condition affecting the 5th cranial nerve (intractable trigeminal neuralgia), its role in GPN is emerging. We herein, report two cases of GPN who showed remarkable response to SRS.

Case Representation

The first patient was a 37 years old gentleman with complaints of severe pain on left side of neck associated with painful swallowing since 2 years. MRI showed a prominent vascular loop (likely left PICA) in the left cerebello medullary cistern abutting left lower cranial nerves. On examination, he had severe pain on swallowing water, painful articulation of vowels, painful gag reflex and lack of taste perception (except bitter taste). He was on a combination of four medications (analgesics, anti-convulsants and muscle relaxant) for pain, with Barrow Neurological Institute (BNI) pain grade of V. Each pain episode lasted several minutes (ranging from few minutes to over an hour), severely affecting his sleep and quality of life. After a diagnosis of GN was established, he was given the option of MVD versus SRS and pros and cons of each modality were explained. He opted for SRS and was planned for Radiosurgery (SRS) to the 9th nerve.
The second patient was a 51-years-old gentleman with severe, sharp, stabbing pain on the right side of his face for six months, exacerbated by swallowing. The pain, initially episodic, had progressed to a constant state, limiting his diet to semi-solid foods. Despite undergoing right glossopharyngeal nerve pulsed radiofrequency with sensory and motor stimulation at another healthcare facility, the patient experienced no pain relief with BNI Grade V despite the use of multiple oral and intravenous analgesics, oral anticonvulsants, and oral steroids. Upon examination, the patient had severe pain when swallowing water, painful articulation of vowels, and a painful gag reflex. Motor, sensory, and taste functions were intact. Given the lack of pain relief despite multiple analgesics following the radiofrequency treatment, the patient was thoroughly counselled on the option of SRS. After obtaining informed consent, a plan was made for SRS targeting the 9th nerve.

Cyberknife treatment planning

The patients were immobilized in supine position and uniframe cast made, with hands by the side. Two radiation planning Computerized Tomography (CT) scans of the brain (with and without contrast) were taken at 1 mm slice thickness and fused with thin 1 mm sequential axial Magnetic Resonance Imaging (MRI) Brain slices for delineation purpose.
The target volume consisted of the distal end of the nerve at the level of glossopharyngeal meatus of the jugular foramen (Figure 1 and 2). Both patients received Cyberknife-based SRS (80 Gy single fraction) to the 9th nerve. The target volume was 0.03 cm^3 and 0.04 cm^3 respectively. Treatment plan was generated using fixed collimator in robotic radiosurgery (Precision® treatment planning system, Accuray Incorporated®, Sunnyvale, CA, USA). The trigeminal path and 6-D skull tracking was chosen for the robot path and in-tra-fractional image tracing during treatment. Dose optimization was performed with sequential optimization algorithm with 5 mm diam-eter fixed collimator.

*Corresponding author: Dr. Deepak Gupta, MD, Division of Radiation Oncology, Medanta The Medicity, Gurgaon 122001, Haryana, India
E-mail: deepakonco@gmail.com

Received: April 14, 2024; Manuscript No: COCR-24-140421 **Editor Assigned:** April 17, 2024; PreQC Id: COCR-24-140421(PQ) **Reviewed:** April 25, 2024; QC No: COCR-24-140421(Q) **Revised:** April 27, 2024; Manuscript No: COCR-24-140421(R) **Published:** April 30, 2024; DOI: 10.4173/cocr.7(4).348

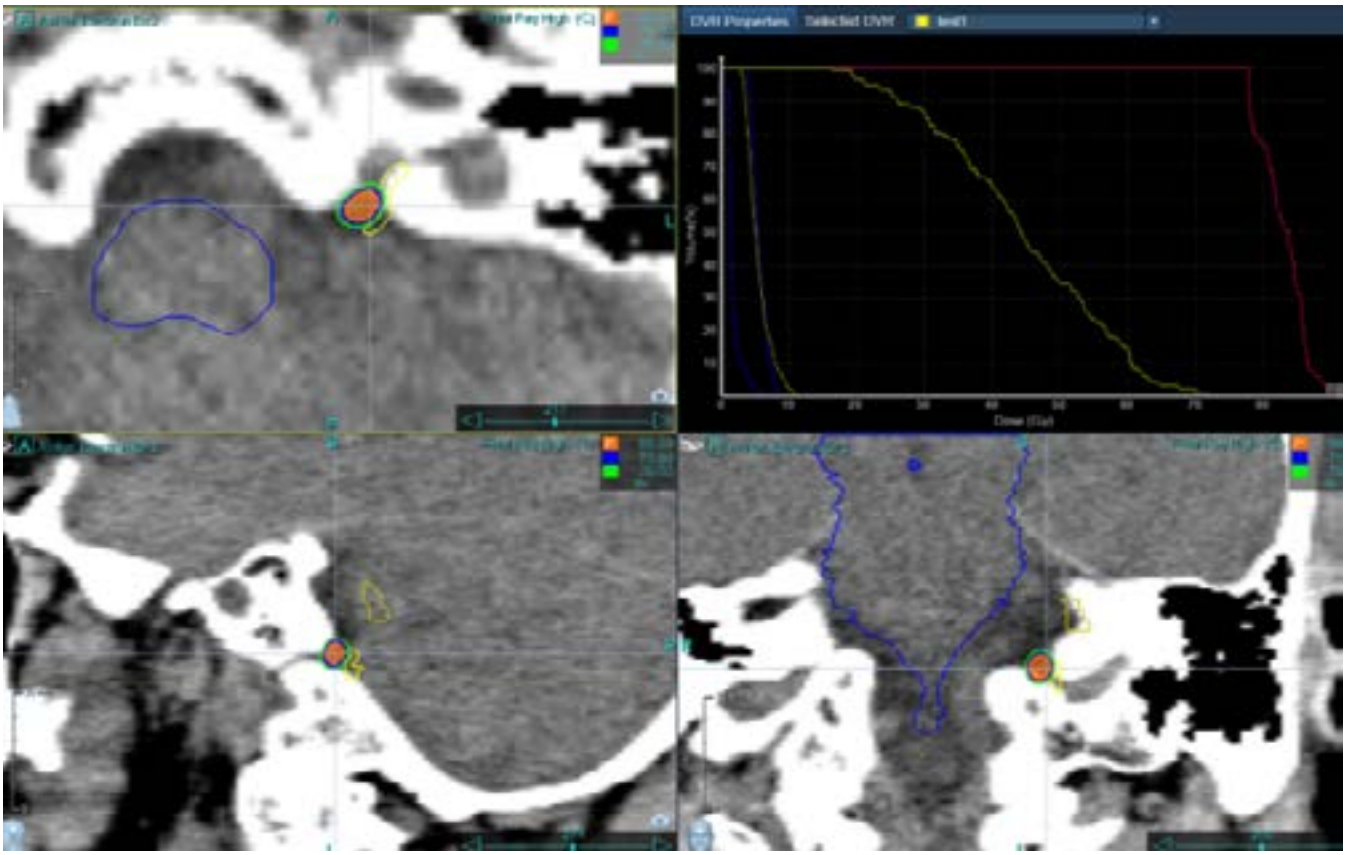

Figure 1: Upper left: Proximity of the target volume (Left glossopharyngeal meatus) depicted in red and the avoidance structure (vagus nerve shown in yellow) showing relationship with brainstem (dark blue). Upper right, Dose Volume histogram showing target volume coverage. Lower left and right: Sagittal and coronal CT images of target volume.

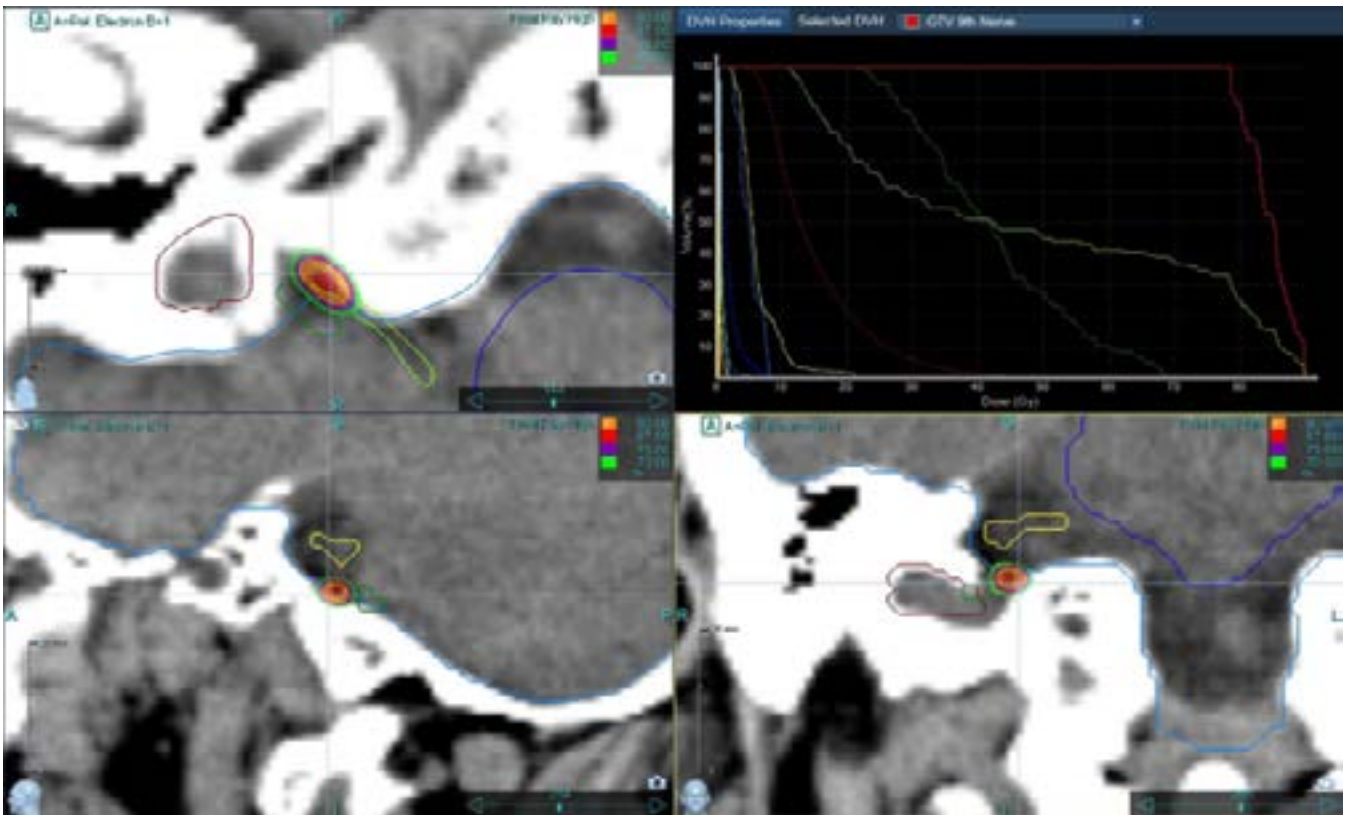

Figure 2: Upper left: Proximity of the target volume (Right glossopharyngeal meatus) depicted in bright red and the avoidance structure (vagus nerve) close to brainstem (dark blue). Upper right, Dose Volume histogram showing target volume coverage. Lower left and right: Sagittal and coronal CT images of target volume.

The target dose objective for minimum dose and maximum dose were 80 Gy and 89 Gy respectively. The maximum dose constraints for the Vagus, brainstem and left cochlea were 70 Gy, 9 Gy and 8 Gy. The achieved dosimetric parameters for both patients were: D 100% to the target - 77.9 Gy and 78 Gy respectively, maximum dose to the vagus - 65.7 Gy and 68.74 Gy, maximum dose to brainstem- 9.2 Gy and 10.33 Gy, and maximum dose to Left cochlea - 8.17 Gy and 8.7 Gy respectively. The dose received by 10 cm3 volume of brain was 5.6 Gy for the first patient and 4.8 Gy for the second patient. After plan evaluation and approval, the Patient Specific Quality Assurance (PSQA) was performed using Stereotactic Dose Verification Phantom (SDVP) and A1SL (Standard Imaging, Madison WI, USA) chamber for the verification of delivery accuracy.

Results

Patient 1

Less than twenty-four hours post SRS, he reported rapid relief in symptoms and was able to swallow water and eat food without any pain. At two weeks, he did not require any pain medications and resumed work 1 month after SRS. Presently 2 years post SRS, patient remains pain free, leading a good quality of life.

Patient 2

Two weeks post SRS, the patient had subjective pain relief by 70%. Pain was still triggered during speaking and there was mild pain reported when swallowing water. Pain management was continued with oral medications. Six weeks post-SRS, he achieved complete pain relief. At 1 year 8 months post SRS, he remains pain free.

Discussion

The proximal trigeminal nerve and root entry zone, which are well defined on MRI, are considered anatomical targets for SRS to the GN. The corresponding bony landmark on a CT scan is the pars nervo-sa (anteromedial part of jugular foramen). However, SRS for GPN is technically challenging due to the close proximity of the vagus nerve (few millimeter posterior to the target).

Most of the reported literature on radiosurgery for GN suggest consid-erable pain relief (Table 1). In the present study, complete pain relief was achieved in two weeks and six weeks respectively. In 1996, a large multi-institutional study of fifty GPN patients treated at five centres received SRS doses ranging from 60 Gy to 90 Gy. The median reported time to pain relief was 1 month [5]. A case of severe, poorly con-trolled pain due to GN in a patient who refused surgery was treated by Gamma knife and reported in 2005 by Stieber et al [6]. He received 80 Gy to the cisternal segment of glossopharyngeal nerve and reported complete pain relief 3 months post SRS.

A French study of 7 patients with intractable GN received 60-80 Gy SRS targeting the cisternal segment (n=2) or glossopharyngeal meatus (n=5) reported that patients who received a dose greater than 75 Gy were cured at long-term follow up [7].

Table 1: Recent publications on radiosurgery for glossopharyngeal neuralgia.

Author; Year of publication	No of patients, Age/ Sex	Symptoms with Duration	MRI Findings	Previous Management	SRS Dose	Response
Evan Chua et al -2020	N=1 54 years (Female)	Piercing right facial pain x 4 years	-	Microvascular decompression 3 pain medications	80 Gy	Significant pain relief within 2 weeks Pain-free at 2 years without medications
V Shankar et al -2020	N=7 Median age 60 years (3 male, 4 female)	Long history of pain (28-70 months)	Neurovascular conflict in 4 cases	Microvascular decompression (n=2) Balloon compression (n=1)	80 Gy (Range, 80-85Gy)	Symptom relief at 7 weeks At 3 months, 5 were pain free
Kano et al -2016	N=22 Median age 60 years (8 male, 14 female)	Pain (1-240 months)	-	Microvascular decompression (n=3) Balloon compression (n=1)	80 Gy	Complete pain relief in 13 patients (59%) at median 12 days (range 1-60 days)
Marc Leveque et al -2011	N=7 Mean age 62 years (5 male, 2 female)	Intractable pain (8-72 months)	Neurovascular conflict in 4 cases	-	60-80 Gy	No pain in 5 patients at 3 months
Hsieh et al -2019	N=1 45 years, Male	Left throat intractable pain (6 months)	-	-	86 Gy	Pain completely disappeared at 2 weeks
John K. O'Connor -2013	N=1 99 years, Female	Electric-shock like pain, 18 months	No evidence of extrinsic compression of brainstem or cranial nerves	Two sphenopalatine blocks 4 pain medications and anti-convulsants	80Gy	Pain relief at 1 month Pain-free at 16 months

Age does not appear to be a detriment to SRS as it is a non- invasive procedure. The oldest reported patient with GN treated by SRS was a 99 year old lady who received 80 Gy to the glossopharyngeal meatus with pain relief at 1 month post SRS [8]. Post SRS, no changes in vocal cord function on swallowing disorders have been reported by Shankar et al in a report of 7 patients treated by frameless radiosurgery [9]. Reports of re-SRS for recurrent GN have shown sustained pain relief and may be a viable alternative to surgical approach [10].

A concerning complication associated with GN is the possibility of cardiac dysrhythmia and instability. Severe irritation and hyper-stimulation of the 9th nerve feedback onto tractus solitarius nucleus of midbrain and via collaterals reach the motor nucleus of the 10th nerve, leading to adversely heightened vagal responses such as cardiac dysrhythmia, bradycardia, and hypotension, with cerebral hypoxia, slowing of EEG activity, syncope, and convulsions [11]. With SRS, the possibility of averting condition-related complications such as cardiac dysrhythmia is an added advantage. Recently, Onabotulinumtoxin A has been reported to be an effective treatment in a patient with refrac-

tory GN, who underwent microvascular decompression twice [12].

Conclusion

Radiosurgery is a compelling treatment option for patients with glossopharyngeal neuralgia who have pain refractory to medications. It leads to an exceptionally prompt response and must be considered a frontline treatment option for patients with disabling pain.

Conflict of Interest

None.

Acknowledgements

We thank the technical and nursing staff of our Institute for assistance in treatment delivery.

References

1. Harris, W. (1922). Persistent pain in lesions of the peripheral and central nervous system.
2. Han A, Montgomery C, Zamora A, Winder E, Kaye A, et al. (2022). Glossopharyngeal neuralgia: epidemiology, risk factors, pathophysiology, differential diagnosis, and treatment options. Health Psychol Res. 10: 36042.
3. Chen J & Sindou M. (2015). Vago-glossopharyngeal neuralgia: a literature review of neurosurgical experience. Acta Neurochir. 157: 311-321.
4. Resnick D K, Jannetta P J, Bissonnette D, Jho H D & Lanzino G. (1995). Microvascular Decompression for Glossopharyngeal Neuralgia: 64. Neurosurgery. 36: 64-69.
5. Kondziolka D, Lunsford LD, Flickinger JC, Young RF, Vermeulen S. et al. (1996). Stereotactic radiosurgery for trigeminal neuralgia: a multiinstitutional study using the gamma unit. J Neurosurg. 84: 940-945.
6. Stieber V W, Bourland J D, & Ellis T L. (2005). Glossopharyngeal neuralgia treated with gamma knife surgery: treatment outcome and failure analysis: case report. J Neurosurg. 102: 155-157.
7. Lévêque M, Park M C, Melhaoui A, Yomo S, Donnet A. et al. (2011). Gamma knife radiosurgery for glossopharyngeal neuralgia: Marseille experience. J. Radiosurgery SBRT. 1: 41.
8. O'Connor J K, & Bidiwala S. (2013). Effectiveness and safety of Gamma Knife radiosurgery for glossopharyngeal neuralgia. In Bayl Univ Med Cent Proc. 26: 262-264. Taylor & Francis.
9. Shankar V, Shreya VS, Vyas H, Bhavya P, Haritha C. et al. (2020). Frameless Radiosurgery for Intractable Idiopathic Glossopharyngeal Neuralgia. Int J Radiat Oncol Biol Phys. 108: 231-232.
10. Kaye J, Daggubati LC, Zeller S, & McInerney J. (2020). Repeat gamma knife radiosurgery for recurrent glossopharyngeal neuralgia: a systematic review and our initial experience Stereotact. Funct. Neurosurg. 98: 324-330.
11. Singh P M, Kaur M, & Trikha A. (2013). An uncommonly common: Glossopharyngeal neuralgia. Ann Indian Acad Neurol. 16: 1-8.
12. Hamilton KT, Seligman R, Blue R, & Lee JY. (2022). Refractory glossopharyngeal neuralgia successfully treated with onabotulinumtoxinA: A case report. Headache: J Head Face Pain. 62: 1424-1428.

Author Afiliations Top

[1]*Division of Radiation Oncology, Medanta The Medicity, Gurgaon 122001, Haryana, India*

[2]*Department of Neurosurgery, Medanta The Medicity, Gurgaon 122001, Haryana, India*