Title

Radiosurgical target distance from the root entry zone in the treatment of trigeminal neuralgia

Journal

Practical Radiation Oncology, 7(4)

ISSN

1879-8500

Authors

Sharim, Justin
Lo, Wei-Lun
Kim, Won
et al.

Publication Date

2017-07-01

DOI

10.1016/j.prro.2016.12.006

Peer reviewed

HHS Public Access
Author manuscript
Pract Radiat Oncol. Author manuscript; available in PMC 2018 July 01.

Published in final edited form as:
Pract Radiat Oncol. 2017 ; 7(4): 221–227. doi:10.1016/j.prro.2016.12.006.

Radiosurgical Target Distance from the Root Entry Zone in the Treatment of Trigeminal Neuralgia

Justin Sharim, BS[1], **Wei-Lun Lo, MD**[2,3], **Won Kim, MD**[2], **Srinivas Chivukula, MD**[2], **Stephen Tenn, PhD**[4], **Tania Kaprealian, MD**[4], and **Nader Pouratian, MD, PhD**[2,4,5,6]

[1]David Geffen School of Medicine at UCLA, Los Angeles, CA, USA

[2]Department of Neurosurgery, David Geffen School of Medicine at UCLA, Los Angeles, CA, USA

[3]Department of Surgery, College of Medicine, Taipei Medical University, Taipei 11031, Taiwan

[4]Department of Radiation Oncology, David Geffen School of Medicine at UCLA, Los Angeles, CA, USA

[5]Brain Research Institute, David Geffen School of Medicine at UCLA, Los Angeles, CA, USA

[6]Neuroscience Interdepartmental Program, David Geffen School of Medicine at UCLA, Los Angeles, CA, USA

Abstract

Introduction—Stereotactic radiosurgery (SRS) provides a noninvasive treatment modality to patients with trigeminal neuralgia who have become refractory to medication. The root entry zone (REZ) has been proposed to be a stereotactic target due to its partial makeup of centrally produced myelin, thus conferring a theoretical increased sensitivity to irradiation, as well as increased susceptibility to neurovascular conflict, making it the site in which nociceptive signals likely arise.

Objective—The aim of this study is to determine if there is a statistically and clinically significant difference in pain relief or facial hypesthesia following SRS based on distance of the stereotactic isocenter from the REZ.

Methods—Patients undergoing Novalis radiosurgery for the treatment of trigeminal neuralgia with at least three months follow-up were included in this study. A 6 mV linear accelerator was used to administer a dose of 90 Gy through a 4 or 5 mm circular collimator. Post-operative outcomes were stratified by Barrow Neurological Institute (BNI) score for pain relief and BNI facial numbness score for facial hypesthesia.

Results—67 patients (24 males) met inclusion criteria and were included in this study. BNI score of I–IIIa was attained in 82% of patients at 3 months, 76% at 6 months, 70% at 9 months, and 65% at 1 year following SRS. After SRS, 14 of 67 patients (21%) reported some degree of facial numbness (BNI facial numbness score II–IV). Distance from isocenter to REZ varied from 0 to 8.6 mm, with mean 1.94 ± 1.62 mm. Logistic regression of target-REZ distance against pain relief

Corresponding Author: Nader Pouratian, UCLA Neurosurgery, 300 Stein Plaza, Ste 562, Los Angeles, CA 90095, USA, npouratian@mednet.ucla.edu, Tel: 310-206-2189, Fax: 310-794-1848.

DISCLOSURE
The authors have no conflicts of interest to disclose

outcome (patients with score I–IIIa and IIIb–V) was insignificant at 3 months (p = 0.988), 6 months (p = 0.925), 9 months (p = 0.845), and 12 months (p = 0.547). Furthermore, no statistically significant correlation was found with logistic regression of target-REZ distance with pain relief outcome (patients with score I and score II–IV) (p = 0.544).

Discussion—The current analysis suggests that distance from the REZ, at least using the techniques described, does not correlate with degree of post-operative pain relief or facial hypesthesia. Thus, targeting specific regions within the trigeminal nerve in relation to these anatomical characteristics may not afford any advantage from this perspective.

Keywords

Trigeminal neuralgia; tic douloureux; stereotactic radiosurgery; linear accelerator; facial pain

INTRODUCTION

Trigeminal neuralgia (TN) is a neuropathic disorder characterized by high intensity electric shock-like attacks of pain limited to one or more branches of the trigeminal nerve. In patients refractory to medication, neurosurgical interventions such as microvascular decompression, radiofrequency dorsal rhizotomy, balloon compression, or stereotactic radiosurgery may play a role[1–4]. Of these therapies, stereotactic radiosurgery (SRS) offers a noninvasive treatment modality, providing an option to patients unwilling or deemed unable to undergo more invasive surgical approaches[5–9]. Previous studies have established the effectiveness of gamma knife radiosurgery in the treatment of TN[8–12]. Radiosurgery using the Novalis linear accelerator, which uses X-rays rather than gamma rays, has also been shown to be effective in the treatment of TN and is becoming increasingly popular[13].

Targeting different sites along the path of the trigeminal nerve has been performed in attempts to maximize pain relief. Previously targeted sites include the gasserion ganglion or retrogasserion zone just posterior to the ganglion, pars triangularis, cisternal segment, and the root entry zone (REZ). The REZ is a transitional area along the trigeminal nerve where the myelin surrounding the axons changes from peripheral myelin produced by schwann cells to central myelin produced by oligodendrocytes[14]. The REZ has been suggested to be more susceptible to radiation damage or vascular compression[9, 14, 15], as oligodentrocytes have been shown to be more sensitive to irradiation than Schwann cells[16, 17]. Thus, the distance of stereotactic target from the REZ may influence the degree of post-operative pain relief.

Facial hypesthesia is a known complication of radiosurgery[18–20]. Prior studies have shown that while higher radiation doses correlate with more successful pain control, they may additionally portend greater degrees of post-operative facial hypesthesia[10, 12, 21]. Given that the relative radiosensitivity of oligodendrocytes to that of schwann cells has already been established in the literature[9, 14, 15], while holding the dose of irradiation constant, proximity to the REZ might thus be hypothesized to increase facial hypesthesia.

The goal of this retrospective study is to determine if there is a statistically and clinically significant difference in pain relief or facial hypesthesia following linear accelerator SRS based on distance of the stereotactic isocenter to the REZ. Of note, in this series, the iscocenter location varied and was largely based on the acuteness of the angle between the trigeminal nerve and brainstem such that the 50% isodose line bordered the pons and the 12Gy dose to the pons was limited to 0.3cc maximum. Therefore, our analysis specifically focused on potential differences in outcome that might have been independently attributable to differences in isocenter distance from the trigeminal REZ.

METHODS

Patient population

From 2012 to 2015, patients with idiopathic or secondary TN consecutively underwent Novalis Radiosurgery at Ronald Reagan UCLA Medical Center. The diagnosis of TN was based on the International Headache Classification (ICHD) second edition criteria[22]. Indications for surgery were pain despite pharmacotherapy or intolerance to adverse effects of medication. Among all patients during this time period, 67 met inclusion criteria and had follow-up available to at least 3 months post-SRS.

SRS Technique

All patients were treated with linear accelerator based SRS (Novalis, BrainLAB, Heimstetten, Germany). All patients included had CISS or FIESTA MRI imaging prior to SRS, which provide superior quality of images within the CSF space to determine cisternal segments of the trigeminal nerve and sites of neurovascular conflict. Neurosurgeons and radiation oncologists cooperated for SRS planning and treatment. A 6 mV linear accelerator, micro-multiple leaf collimator, and ExacTrac patient positioning were integrated in the Novalis Radiosurgery system. On the day of treatment, the patient was immobilized with a custom-molded bivalve-style thermoplastic mask. A computed tomography scan usng a fiducial locator was obtained and data was transferred to a local network of iPlan Net system (BrainLAB AG, Feldkirchen, Germany). A maximum dose of 90 Gray was given via a 4 or 5 mm circular collimator. The isocenter was placed over the root entry zone, cisternal segment, or Meckel's cave region, such that the 50% isodose line was along the pons. The location of the isocenter was thus primarily based on the angle between the trigeminal nerve and the brainstem surface, with more acute angles rendering isocenter distances further away from the root entry zone so as to minimize irradiation to the brainstem.

Patient follow-up and outcome evaluations

All patients' charts retrospectively reviewed for outcome assessment. Patients were additionally telephoned to confirm chart review and determine more recent follow-up via a questionnaire assessing the degree of pain relief, patterns of facial pain before treatment, the time interval between treatment and pain relief, the patient's use of medications before and after treatment, and degree of facial hypesthesia, if any.

Patients' pain relief outcomes were scored according to the Barrow Neurological Institute (BNI) pain intensity scale (table 1)[23]. BNI scores were divided into a binary scale with scores I-IIIa falling under "good pain relief" and scores IIIb-V falling under "poor pain relief". Patients' degree of facial hypesthesia, if any, was scored according to BNI Facial numbness score, as shown in table 2.

MRI measurements

Preoperative magnetic resonance images were retrospectively reviewed by a neurosurgeon. The REZ was defined as the segment of the trigeminal nerve, 6 mm in length adjacent to the brainstem, as reported by prior literature[24], and situated 2 mm away from the pons. The distance of the isocenter from the REZ was measured (Figure 1). Representative examples of a preoperative MRI reviewed retrospectively for target-REZ distance measurement is shown in figure 1 A–B.

Statistical Analysis

Data are presented as the mean ± standard deviation for continuous variables and frequencies/percentages for categorical variables. A univariate logistic regression was used to evaluate the relationship between target-REZ distance and outcome (good outcome vs poor outcome) as well as degree of facial hypesthesia (BNI score of I vs II, III, IV). Student's t test (unpaired, two-tailed, equal variance) was additionally employed to determine if there was a difference in target-REZ distance between those with good pain relief and those with poor pain relief, as well as between those with and without facial hypesthesia (BNI facial numbness score of I vs II, III, and IV). The threshold level of significance for all analyses was set at $p \leq 0.05$.

RESULTS

Sixty seven patients were identified with follow-up to at least 3 months, of which 24 were males and 43 were females. Average age at the time of operation across all patients was (mean ± standard deviation).

At 3 months post-SRS, 82.1% of patients had good pain relief (BNI score of I – IIIa), of which 52.2% reporting complete pain relief (BNI score of I). At 6 months, 76.4% of patients with available follow-up had good pain relief, with 56.9% having complete relief. At 9 months, 70.5% of patients had good relief, with 56.8% having complete relief. Finally, at 1 year, 65.0% of patients had good relief, with 50.0% reaching complete relief. A summary of this data with numbers of patients stratified by BNI score is provided in table 3.

After SRS, 14 of 67 patients (21%) reported some degree of facial numbness (BNI facial numbness score II-IV). Thirteen patients had a BNI facial numbness score of II, one patient had a score of III, and no patients had a score of IV.

Distance from isocenter to REZ varied from 0 to 8.6 mm, with mean 1.94 ± 1.62 mm. Logistic regression of target-REZ distance against pain relief outcome (patients with score I-IIIa and IIIb-V) was insignificant at 3 months (p = 0.988), 6 months (p = 0.925), 9 months (p = 0.845), and 12 months (p = 0.547). Patients with good pain relief at 3 months follow-up had mean distance from the REZ of 1.88 mm ± 1.42 mm while those with poor pain relief had mean distance of 1.89 ± 1.67 mm (p = 0.987). At 6 months follow-up, patients with good pain relief outcomes had a mean target REZ distance of 1.94 ± 1.84 mm, while those with poor pain relief outcomes had mean distance of 1.72 ± 1.24 mm ($p = 0.648$). Similarly, no significant difference in target-REZ distance between patients with good and poor pain relief was found at 9 months follow-up (2.08 ± 1.89 mm and 1.62 ± 1.33 mm, respectively) ($p = 0.369$) or 1-year follow-up (1.76 ± 1.55 mm and 2.11 ± 2.21 mm, respectively) ($p = 0.600$).

No statistically significant correlation was found with logistic regression of target-REZ distance with BNI facial numbness score (patients with score I and score II-IV) ($p = 0.544$). Patients without facial hypesthesia (score I) had a mean target-REZ distance of 2.15 ± 1.64 mm, while those with some degree of facial hypesthesia had a mean target-REZ distance of 1.81 ± 1.63 mm ($p = 0.500$).

DISCUSSION

Stereotactic radiosurgery provides a noninvasive neurosurgical intervention to patients with trigeminal neuralgia who have become refractory to medication. Controversy exists as to the best region within the trigeminal nerve to target. This study fails to identify a difference in both pain relief as well as facial hypesthesia based on distance of the stereotactic target from the REZ.

Prior studies have reported targets across various sites of the trigeminal nerve, with similar degrees of success relative to one another: Kondziolka et al.[9] targeted REZ and achieved a success rate of significant pain relief of 94%. Meanwhile, Régis et al targeted a more distal portion of the trigeminal root, just immediately posterior to the gasserion ganglion, also finding a high rate of effective pain control[25]. Massager and colleagues[21, 26] similarly targeted patients slightly more distally, at the pars triangularis located 6–8 mm away from the brainstem. They found that while the pars triangularis varies in its distance from the brainstem by the cisternal length of the trigeminal nerve root[27], the effectiveness of the procedure was based on the distance away from the brainstem, with shorter distances predicting greater pain relief, albeit at increased risk of facial hypesthesia. They thus concluded that the target should not be determined by anatomic site, but rather, distance away from the pons. However, Marshall et al[28] later targeted both the REZ in some patients and the more distal pars triangularis in others, and found no difference in outcomes based on distance away from pons. However, they found that the dose to the REZ correlated with the degree of facial numbness, suggesting that further distances from the REZ would decrease the degree of postoperative facial numbness. In this study, no significant difference in facial hypesthesia was found based on the distance from the REZ.

While various sites within the trigeminal nerve have been targeted, there exists a heterogeneity in radiation doses across these studies. Moreover, the dose rate used for treatment[26, 29] as well as the output factor used in dosimetry calculation[18, 19, 21] can also significantly affect biological effects of otherwise identical prescribed dosages, adding additional potential confounders between institutions in the presented studies. Studies examining the effect of target location on outcome used gamma knife; while linear accelerator-based radiosurgery has been shown to be effective and has been increasingly performed[13, 27, 30], to the best of our knowledge, no studies have focused directly on successes via targeting different regions within the trigeminal nerve.

The current analysis suggests that when targeting the 50% isodose line at the brainstem, the distance from the REZ does not correlate with degree of post-operative pain relief or facial hypesthesia. Thus, targeting different sites along the trigeminal nerve in relation to these anatomical characteristics may not afford any advantage from this perspective. This said however, anatomic studies at autopsy have revealed anastomoses between the sensory and motor rootlets (frequency of which varies with patient-specific anatomy) occurring most prominently in the retrogasserion zone, which have been suggested to partially underlie accidental preservation of sensation in some patients following surgical procedures such as dorsal rhizotomy[31]. Thus, targets more distal to these anastomoses, such as at the gasserion ganglion, may offer a theoretical advantage from this perspective.

This study is limited by its sample size, and the single center and retrospective design inherently limit this study's power and generalizability. The current results, however, are unlikely to represent a type II (false negative) error in that the data do not even suggest a trend toward a difference in outcomes based on target distance from the REZ. Furthermore, any statistically significant difference is unlikely to be clinically meaningful, given the large variance in distance across subjects. Nevertheless, the already small sample size limits the ability to control for other variables (eg cause of facial pain, prior procedures) which would further subdivide the patient population. Second, the 50% isodose line remaining at the brainstem border further confound the results of this study, and restrict the generalizability of the results to patients undergoing this albeit well-established protocol. Moreover, follow-up time presented is inadequate to account for differences in duration of pain relief, as some patients with poor pain relief outcomes opted to undergo repeat surgery, thus prematurely curtailing their follow-up and excluding them from analysis at later time points. A proportion of patients were also clinically lost to follow-up – as patients with better outcomes often did not return, there may exist a selection bias for patients with poorer outcomes. This limitation is thought to be lessened by telephone follow-up with patients to both confirm chart review and obtain more recent follow-up. Moreover, while this bias will affect a proportion of patients with outcomes, it should likely not affect the relationship between imaging characteristics and outcome.

Acknowledgments

We thank the UCLA Statistical Consulting Group through the Institute for Digital Research and Education (IDRE) for assistance with statistical analysis.

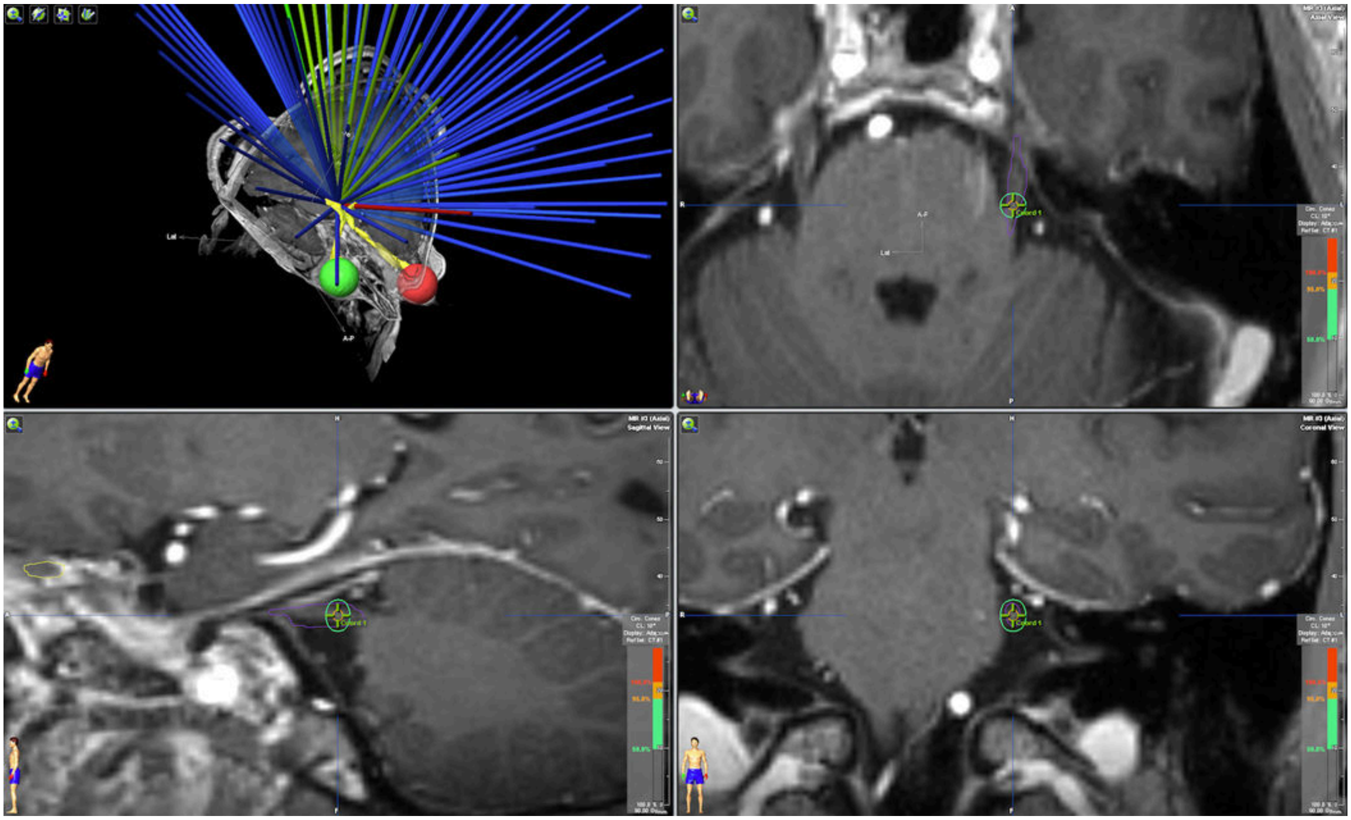
This work is supported by funds provided by National Institute of Biomedical Imaging and Bioengineering under Award Number K23EB014326 (N.P.).

References

1. Phan K, Rao PJ, Dexter M. Microvascular decompression for elderly patients with trigeminal neuralgia. J Clin Neurosci. 2016
2. Lopez BC, Hamlyn PJ, Zakrzewska JM. Systematic review of ablative neurosurgical techniques for the treatment of trigeminal neuralgia. Neurosurgery. 2004; 54:973–982. discussion 982–973. [PubMed: 15046666]

3. Asplund P, Blomstedt P, Bergenheim AT. Percutaneous Balloon Compression vs Percutaneous Retrogasserian Glycerol Rhizotomy for the Primary Treatment of Trigeminal Neuralgia. Neurosurgery. 2016; 78:421–428. [PubMed: 26465639]
4. Missios S, Mohammadi AM, Barnett GH. Percutaneous treatments for trigeminal neuralgia. Neurosurg Clin N Am. 2014; 25:751–762. [PubMed: 25240662]
5. Lettmaier S. Radiosurgery in trigeminal neuralgia. Physica Medica-European Journal of Medical Physics. 2014; 30:592–595.
6. Regis J, Tuleasca C. Fifteen years of Gamma Knife surgery for trigeminal neuralgia in the Journal of Neurosurgery: history of a revolution in functional neurosurgery. Journal of Neurosurgery. 2011; 115:2–7. [PubMed: 22401808]
7. Leksell L. Sterotaxic radiosurgery in trigeminal neuralgia. Acta Chir Scand. 1971; 137:311–314. [PubMed: 4948331]
8. Sheehan J, Pan HC, Stroila M, Steiner L. Gamma knife surgery for trigeminal neuralgia: outcomes and prognostic factors. J Neurosurg. 2005; 102:434–441. [PubMed: 15796376]
9. Kondziolka D, Lunsford LD, Flickinger JC, et al. Stereotactic radiosurgery for trigeminal neuralgia: a multiinstitutional study using the gamma unit. J Neurosurg. 1996; 84:940–945. [PubMed: 8847587]
10. Balamucki CJ, Stieber VW, Ellis TL, et al. Does dose rate affect efficacy? The outcomes of 256 Gamma Knife surgery procedures for trigeminal neuralgia and other types of facial pain as they relate to the half-life of cobalt. Journal of Neurosurgery. 2006; 105:730–735. [PubMed: 17121135]
11. Kondziolka D, Lacomis D, Niranjan A, et al. Histological effects of trigeminal nerve radiosurgery in a primate model: Implications for trigeminal neuralgia radiosurgery. Neurosurgery. 2000; 46:971–976. [PubMed: 10764273]
12. Young B, Shivazad A, Kryscio RJ, St Clair W, Bush HM. Long-term outcome of high-dose Gamma Knife surgery in treatment of trigeminal neuralgia Clinical article. Journal of Neurosurgery. 2013; 119:1166–1175. [PubMed: 23600932]
13. Chen JCT, Rahimian J, Rahimian R, Arellano A, Miller MJ, Girvigian MR. Frameless Image-Guided Radiosurgery for Initial Treatment of Typical Trigeminal Neuralgia. World Neurosurgery. 2010; 74:538–543. [PubMed: 21492609]
14. Xu Z, Schlesinger D, Moldovan K, et al. Impact of target location on the response of trigeminal neuralgia to stereotactic radiosurgery. J Neurosurg. 2014; 120:716–724. [PubMed: 24313616]
15. Love S, Coakham HB. Trigeminal neuralgia: pathology and pathogenesis. Brain. 2001; 124:2347–2360. [PubMed: 11701590]
16. Mastaglia FL, McDonald WI, Watson JV, Yogendran K. Effects of x-radiation on the spinal cord: an experimental study of the morphological changes in central nerve fibres. Brain. 1976; 99:101–122. [PubMed: 963528]
17. Mehta MP, Kinsella TJ. Cavernous sinus cranial neuropathies: is there a dose-response relationship following radiosurgery? Int J Radiat Oncol Biol Phys. 1993; 27:477–480. [PubMed: 8407425]
18. Pollock BE, Phuong LK, Foote RL, Stafford SL, Gorman DA. High-dose trigeminal neuralgia radiosurgery associated with increased risk of trigeminal nerve dysfunction. Neurosurgery. 2001; 49:58–62. [PubMed: 11440460]
19. Pollock BE, Phuong LK, Gorman DA, Foote RL, Stafford SL. Stereotactic radiosurgery for idiopathic trigeminal neuralgia. Journal of Neurosurgery. 2002; 97:347–353. [PubMed: 12186463]
20. Maesawa S, Salame C, Flickinger JC, Pirris S, Kondziolka D, Lunsford LD. Clinical outcomes after stereotactic radiosurgery for idiopathic trigeminal neuralgia. Journal of Neurosurgery. 2011; 115:14–20.
21. Massager N, Lorenzoni J, Devriendt D, Desmedt F, Brotchi J, Levivier M. Gamma knife surgery for idiopathic trigeminal neuralgia performed using a far-anterior cisternal target and a high dose of radiation. Journal of Neurosurgery. 2004; 100:597–605. [PubMed: 15070111]
22. Classification and diagnostic criteria for headache disorders, cranial neuralgias and facial pain. Headache Classification Committee of the International Headache Society. Cephalalgia. 1988; 8(Suppl 7):1–96.

23. Rogers CL, Shetter AG, Fiedler JA, Smith KA, Han PP, Speiser BL. Gamma Knife radiosurgery for trigeminal neuralgia: The initial experience of the Barrow Neurological Institute. International Journal of Radiation Oncology Biology Physics. 2000; 47:1013–1019.
24. Lang E, Naraghi R, Tanrikulu L, et al. Neurovascular relationship at the trigeminal root entry zone in persistent idiopathic facial pain: findings from MRI 3D visualisation. Journal of Neurology Neurosurgery and Psychiatry. 2005; 76:1506–1509.
25. Régis J, Bartolomei F, Metellus P, et al. Radiosurgery for trigeminal neuralgia and epilepsy. Neurosurg Clin N Am. 1999; 10:359–377. [PubMed: 10099103]
26. Massager N, Lorenzoni J, Devriendt D, Levivier M. Radiosurgery for trigeminal neuralgia. Prog Neurol Surg. 2007; 20:235–243. [PubMed: 17317992]
27. Goss BW, Frighetto L, DeSalles AA, Smith Z, Solberg T, Selch M. Linear accelerator radiosurgery using 90 gray for essential trigeminal neuralgia: results and dose volume histogram analysis. Neurosurgery. 2003; 53:823–828. discussion 828–830. [PubMed: 14519214]
28. Marshall K, Chan MD, McCoy TP, et al. Predictive variables for the successful treatment of trigeminal neuralgia with gamma knife radiosurgery. Neurosurgery. 2012; 70:566–572. discussion 572–563. [PubMed: 21849918]
29. Kondziolka D, Lunsford LD, Habeck M, Flickinger JC. Gamma knife radiosurgery for trigeminal neuralgia. Neurosurg Clin N Am. 1997; 8:79–85. [PubMed: 9018708]
30. Varela-Lema L, Lopez-Garcia M, Maceira-Rozas M, Munoz-Garzon V. Linear accelerator stereotactic radiosurgery for trigeminal neuralgia. Pain Physician. 2015; 18:15–27. [PubMed: 25675056]
31. Gudmundsson K, Rhoton AL, Rushton JG. Detailed anatomy of the intracranial portion of the trigeminal nerve. J Neurosurg. 1971; 35:592–600. [PubMed: 5120007]



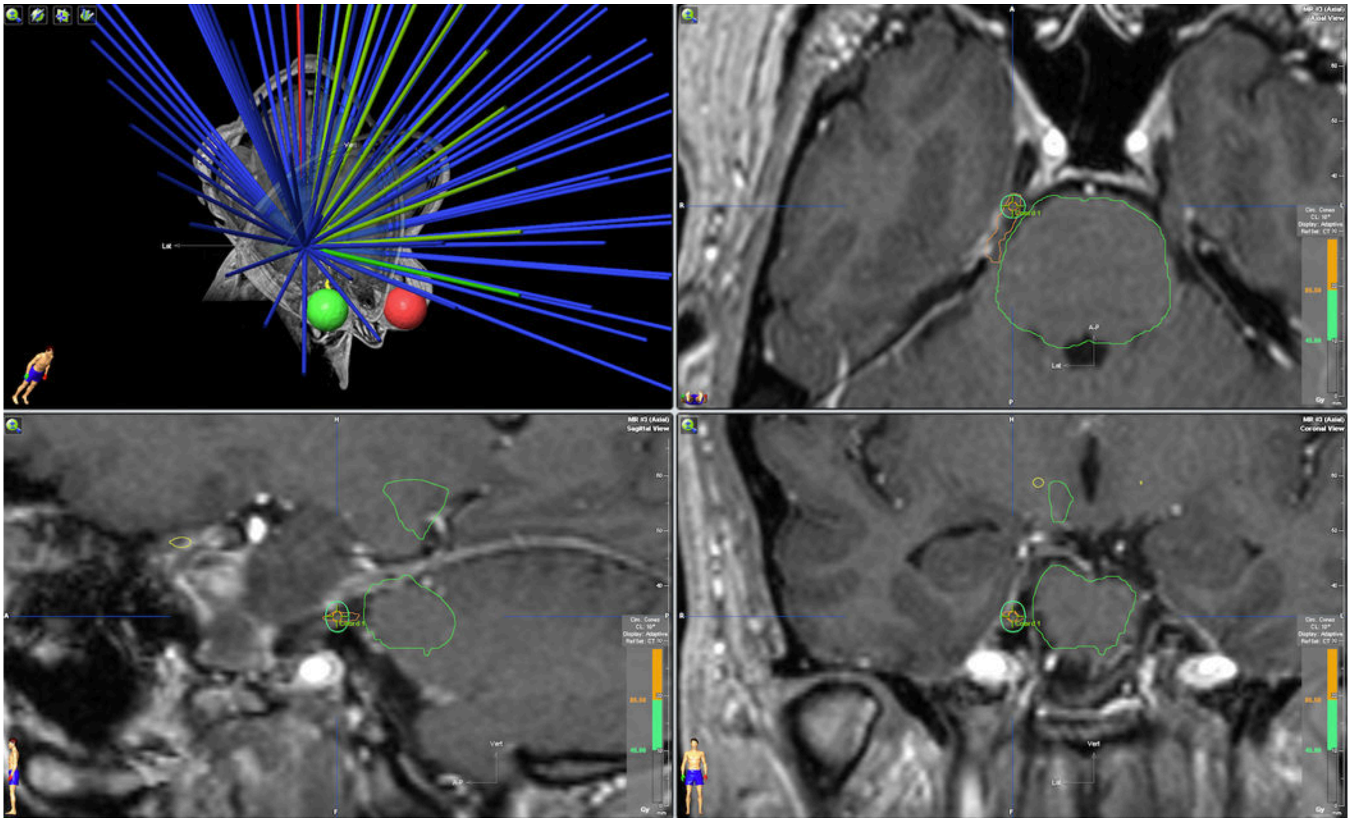


Figure 1.

Pre-operative T1-weighted magnetic resonance imaging showing SRS plans of the trigeminal nerve with isocenter located 0 mm (located on the REZ) (A) and 4.5 mm (B) from the root entry zone. Green circle depicts the 50% isodose line, bordering the pons. Note the difference in angle acuity between the trigeminal nerve and brainstem between the two images.

Table 1

Barrow Neurological Institute Scores

BNI Score	Outcome
I	No pain, no medications
II	Occasional pain, no medications
IIIa	No pain, taking medications
IIIb	Pain, controlled w/medications
IV	Pain, not well controlled w/medications
V	Severe pain/no pain relief

Table 2

Barrow Neurological Institute Facial Numbness Scores

Score	Outcome
I	No facial numbness
II	Mild facial numbness, not bothersome
III	Facial numbness, somewhat bothersome
IV	Facial numbness, very bothersome

Author Manuscript

Author Manuscript

Author Manuscript

Table 3

Number of patients with BNI Score I–V with follow-up at 3 months to 1 year post-SRS

BNI score	3 months	6 months	9 months	12 months
I	35	29	25	20
II	9	4	3	2
IIIa	11	6	3	4
IIIb	3	4	4	3
IV	5	5	7	9
V	4	3	2	2
Totals	**67**	**51**	**44**	**40**