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Microvascular Decompression for Trigeminal Neuralgia in Patients with and without Prior Stereotactic Radiosurgery

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Key words
- Microvascular decompression
- Pain
- Posterior fossa exploration
- Radiation
- Radiosurgery
- Trigeminal neuralgia
- Vasculitis

Abbreviations and Acronyms
BNI: Barrow Neurological Institute
LINAC: Linear accelerator
MVD: Microvascular decompression
SRS: Stereotactic radiosurgery
TN: Trigeminal neuralgia


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BACKGROUND: **Radiosurgery has emerged as an important primary treatment means of typical trigeminal neuralgia. Despite its high safety and efficacy, the likelihood of recurrence is significant, potentially requiring salvage treatment. Posterior fossa exploration and microvascular decompression is an option for salvage treatment. Results are presented regarding a single-surgeon experience, and a grading scale is proposed for postirradiation surgical findings.**

METHODS: **A retrospective analysis of the author's experience with 109 consecutive posterior fossa explorations for typical trigeminal neuralgia performed over a period of 8 years is included in this analysis. There were 42 patients undergoing microvascular decompression following recurrence of pain after radiosurgery, and 67 patients underwent microvascular decompression without prior radiosurgery. Operative findings were reviewed and categorized. A 4-category typing system is proposed. The Barrow Neurological Institute Pain Scale Score was used to categorize post–microvascular decompression outcomes.**

RESULTS: **Within the postradiosurgery group, 41 of 42 patients had initial treatment success (Barrow Neurological Institute score 1 to 3), comparing favorably with the nonirradiated group, in which 59 of 67 patients had initial successful treatment ($P = 0.15$, Fisher exact test, 2-tailed). Findings of conflicting vessel atherosclerosis and adhesions between conflicting vessel and nerve were only seen in the postradiosurgery group, whereas arachnoid thickening requiring sharp dissection was seen in both postradiosurgery and nonirradiated groups. Increased difficulty of dissection in either the radiosurgery or the nonirradiated groups did not appear to affect the likelihood of satisfactory outcome.**

CONCLUSIONS: **Microvascular decompression can be performed in the postradiosurgery setting safely with high efficacy. Dissection typically was not significantly more difficult in comparison to procedures performed without prior history of radiosurgery intervention.**

INTRODUCTION

Trigeminal neuralgia (TN) is one of the more deeply investigated surgically responsive pain syndromes. A wide number of treatment options are available, including percutaneous methods, radiosurgery, and microvascular decompression (MVD). Stereotactic radiosurgery (SRS) has become a popular means of treatment, with extremely low complication rates and satisfactory initial good response rates (5, 7, 10, 12, 17, 18, 22). Nevertheless, salvage treatments are often needed after recurrence of facial pain. The median time to recurrence of pain after initially successful radiosurgery is in the neighborhood of 50% at 3 years after treatment (7, 12, 17). MVD is an option for patients after recurrence of pain or failure after radiosurgery. Few reports exist regarding the effect of prior radiosurgery on MVD (1, 21). Regarding the technical execution of MVD, a small number of patients and intraoperative findings have been reported. The consensus based on several cases reported in the literature thus far is that there is no significant change in surgical difficulty. Nevertheless, findings can include radiation-induced vasculitis involving the compressing artery, arachnoid thickening, and adhesions between vessel and nerve (13).

Table 1. Proposed Type Designation System for Dissection Difficulty in Microvascular Decompression Procedures After Radiosurgery

Type	Visible Changes	Effect on Dissection
0	No evidence of change	No effect on dissection
1	Positive evidence of radiation-related effect	No effect on dissection
2	Variable evidence of radiation-related effect Thickened arachnoid	Sharp dissection required
3	Positive evidence of radiation-related effect	Adhesions between vessel and nerve, significant increase in difficulty of dissection

Type 2 dissection difficulty can be observed in nonirradiated patients.

The present study is a single-surgeon consecutive experience of MVD for TN following recurrence after recurrence or incomplete response after radiosurgery. This subseries is compared against similar patients during the same time period who did not receive prior radiosurgery.

METHODS

Patient Population

This is a retrospective analysis of a consecutive series of patients who have undergone MVD by the author. Over an 8-year period, the author performed 109 MVD for trigeminal facial pain corresponding to Burchiel class 1 and 2 (4). Of these, 42 were performed in the postradiosurgery setting. In all postradiosurgery patients, MVD was performed for either recurrence of pain or partial but insufficient relief of pain after SRS. All patients had pain not adequately controlled with medications or suffered from intolerable side effects from medication.

Radiosurgery Technique

Patients had been treated with either gamma knife radiosurgery (Elekta, Stockholm, Sweden) at a single outside facility as well as linear accelerator (LINAC) radiosurgery performed by the author using Brainlab Novalis (Brainlab AG, Feldkirchen, Germany). The methods at both of these centers as well as representative results have previously been published. The gamma knife patients were treated to maximum dose of 88 Gy for initial treatments and 44 Gy for retreatments (23). LINAC initial treatments were performed to a Dmax of 90 Gy for initial radiosurgery treatments and 60 Gy for repeat treatments (5, 6).

Clinical Patient Assessment

All patients were followed up with assessment batteries including the Barrow Neurological Institute (BNI) Pain Scale Score (20). The BNI scores are as follows: I, no pain; II, occasional pain not requiring medication; IIIa, no pain but continued medication; IIIb, some pain, controlled with medication; IV, some pain, not controlled with medication; and V, severe pain/no pain relief. Patients were considered to have recurrence of pain when their BNI score moved to a level 4, some pain not adequately controlled with medications. Upon recurrence of pain, patients were counseled and offered a procedure where appropriate.

MVD Technique

All MVDs utilized a key-hole microsurgical approach with the patient in either a supine or a park-bench position (3). An approach centered on the petrotentorial angle was used. Intraoperative auditory evoked potentials were utilized for monitoring hearing integrity. Separation between nerve and offending blood vessel was maintained with Teflon padding using an interposition technique in all cases.

Assessment of Operative Findings

Intraoperative video recordings were available for review in 105 cases. Intraoperative findings were reviewed and categorized by the author. In addition, operative notes describing findings were reviewed for all cases.

A 4-category typing system was developed for intraoperative findings, and is presented in **Table 1**. Examples of postradiation changes are shown in **Figures 1, 2,** and **3**. Radiation-related effects included thickened arachnoid as well as atherosclerotic changes within the conflicting vessel. In some cases, significant adhesions between nerve and vessel were encountered that could not be lysed with blunt dissection only. In these cases, sharp dissection with fine microscissors was required.

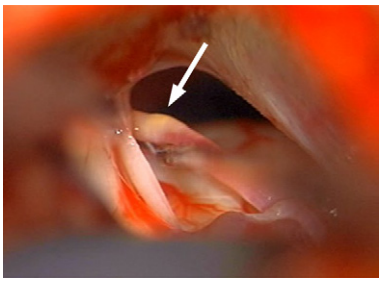

Figure 1. Left-sided microvascular decompression in a patient after 2 prior radiosurgery procedures. Note radiation-related atherosclerotic changes (indicated by *arrow*) in conflicting superior cerebellar artery held away from nerve by microdissection tool. There was no increase in difficulty of dissection. These findings were designated as type 1 changes.

In nonirradiated patients, atherosclerotic changes were never seen, although in some cases, thickened or tenacious arachnoid membranes were seen requiring sharp dissection. Such cases were given a type 2 designation.

Data Analysis

Univariate analysis was performed using Fisher exact test for contingency tables and Mann-Whitney U test for continuous variables. Survival analysis was performed using Kaplan-Meier curves. This study was approved by the local institutional review board.

RESULTS

Over an 8-year period, the author has managed with MVD 109 patients for TN; 42 of these cases were for recurrence of facial pain after initially successful radiosurgery. The patient population is presented in **Table 2**. The radiosurgery and nonirradiated groups differed in gender distribution as well as age and length of disease, likely reflecting selection biases in terms of initial management strategies. In the nonradiosurgery group, 3 patients had prior percutaneous glycerol rhizolysis. Two patients in the postradiosurgery group also underwent percutaneous glycerol rhizolysis before MVD.

Surgical Findings

The configuration of conflicting blood vessels is presented in **Table 3**. There were no