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Immediate and Long-term Outcomes of Microvascular Decompression for Mixed Trigeminal Neuralgia

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Abstract

Objective: Classic trigeminal neuralgia (TN) involves sharp, shooting pain in any trigeminal nerve distribution, whereas atypical TN presents with constant aching, numbness or burning that can appear with classic features, leading to a mixed presentation. Microvascular decompression (MVD) is an effective treatment for classic TN, but its utility in treating mixed TN is less studied.

Methods: We retrospectively studied 73 adult patients with mixed TN and 386 classic TN patients, who all underwent MVD between December 2007 and October 2016. Recorded variables included demographics, graded radiologic and intraoperative findings, and graded pain outcomes in the immediate postoperative period (up to 3 months after MVD) and long-term follow-up.

Results: Mean age of mixed TN patients was 53.2 years. Immediate postoperative outcomes were as follows: 67 (91.8%) had pain relief including improvement of atypical pain, while six patients (8.2%) had no pain relief. Having pre-existing pain syndromes ($p=0.001$) or distortion of trigeminal nerve intraoperatively ($p=0.001$) were associated with poor surgical outcome for mixed TN. Mean length of follow-up was 20.6 months. Forty-four patients (60.3%) developed recurrence of any TN pain. In comparison, 93% of classic TN patients had pain relief in the immediate postoperative period, and recurrence rate was 19.9%.

Conclusions: Patients with mixed TN suffer from both classic and atypical TN symptoms. 91.8% of our cohort reported partial or complete pain relief including improvement of atypical pain following MVD in the immediate post-operative stage, compared to 93% of the classic TN cohort. 60.3% of mixed TN patients eventually developed TN recurrence.

Disclosure- Conflicts of Interest

All other authors have no conflicts of interest.

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Keywords

trigeminal neuralgia; microvascular decompression; atypical facial pain; mixed facial pain

Introduction

Trigeminal neuralgia (TN) is a chronic pain disorder of the trigeminal nerve, presenting with both classic and atypical forms. Classification of TN has been long debated, with some establishing a difference between two types of TN and of atypical facial pain.^{1,2} Classic TN (TN type 1) consists of sporadic sharp, electricity-like shooting pain that can course in the ophthalmic (V1), maxillary (V2), or mandibular (V3) distribution on one side of the face, whereas TN type 2 is a rarer occurrence characterized more by constant aching, numbness or burning aspects. While Eller et al. describes “atypical facial pain” as pain specifically arising from a psychological source, atypical TN (TN type 2) can also refer to unilateral, burning, and aching pain.^{1,3} For some patients, atypical TN symptoms can appear along with classic TN type 1 features, leading to a mixed presentation. Treatment options available for TN include medical management with anti-convulsant medications or narcotics, as well as a variety of procedures.

Microvascular decompression (MVD) is a common and well-supported neurosurgical procedure for TN during which a vascular structure contacting and compressing the trigeminal nerve is mobilized and kept separate from the nerve with a sponge-like barrier. First introduced by Dandy and described in detail by Jannetta et al. since 1967, MVD is performed beneath the microscope in order to visualize the trigeminal nerve and place Teflon pledgets to relieve the nerve compression by overlying vasculature or other structures.⁴⁻⁶ The outcomes for classic TN relief following MVD are impressive, with 83.5-96.7% of patients experiencing complete pain relief with no recurrence over long-term follow-up.^{3,7,8} MVD appears to provide the greatest improvement in quality of life as well as confers the least likelihood of pain recurrence and need for additional treatment when compared to other treatments such as radiofrequency, rhizotomy, and stereotactic radiosurgery.^{9,10} However, existing surgical and radiosurgical series report a lower MVD response rate for patients with any atypical symptoms than for patients with classic TN type 1.^{3,11} Other methods have subsequently been attempted to treat atypical facial pain symptoms in particular with a variety of methods, including sphenopalatine ganglion blockade and ophthalmic branch radiofrequency thermocoagulation.^{12,13}

We present a series of primarily 73 consecutive patients treated by MVD at one institution with a mixed presentation of both atypical and classic symptoms as well as 386 patients with classic TN type 1 pain and report on risk factors for poorer immediate (within 1-3 months) postoperative pain outcomes, as well as outcomes after longer-term follow-up. The purpose of our study was therefore to 1) characterize the population of patients suffering from mixed TN, 2) characterize MVD outcomes in the immediate postoperative period for mixed TN in comparison with classic TN, and 3) identify factors associated with increased odds of poor surgical outcome and recurrence in long-term follow-up for mixed TN.

Methods and Materials

Patient Selection

All adult patients (age >18) who underwent MVD for TN with both classic and atypical features (defined as mixed TN in this study) at one institution between August 2008 and October 2016 were included in this retrospective study. In addition, all patients with classic TN-only symptoms who underwent MVD by author M.L. at one institution between December 2007 and October 2016 were included for analysis. TN secondary to schwannoma, meningioma, other cerebropontine angle tumors, aneurysm, or multiple sclerosis were excluded. Patients with solely TN type 2 were not referenced in this study due to the clinical practice at the institution; these patients with only atypical facial pain were referred to facial pain specialists rather than for MVD.

Surgical Technique

All MVDs were performed using the suboccipital approach. An approximately 5-6 cm S-shaped incision to encompass the lesion was made. The dura and cisterna magna were opened after identifying the sigmoid-transverse junction. Vessels overlying the trigeminal nerve were freed and then mobilized off the trigeminal nerve with Teflon pledgets.

Recorded Variables

Clinical and operative notes for each patient were retrospectively reviewed with IRB approval. Data variables collected and recorded included patient demographic information, location and distribution of TN pain, co-morbidities, previous interventions for TN, radiologic data that involved use of the institutional TN imaging protocol (which included MRI FIESTA), perioperative data, and postoperative clinical follow-up data on pain outcomes, medication management, and rate of facial pain symptoms recurrence. Time of recurrence of facial pain was also recorded, in addition to need for additional TN procedures following the MVD. Radiologic and intra-operative data included extent of trigeminal nerve compression (graded as I for compression, distortion, deviation of nerve; II for simple contact of nerve; III for no contact or compression of nerve) and type of vessel or material compressing the trigeminal nerve. Postoperative pain outcomes were graded as I for >90% pain relief with all discharge TN/pain medications weaned, II for >90% pain relief with minimal change in discharge TN/pain medications, III for partial pain relief (<90%) with minimal change in discharge TN/pain medications, IV for no pain relief or worsening pain with no change in discharge TN/pain medications. The immediate postoperative period was defined as up to 3 months following the MVD. Complications following the surgery were also recorded based on clinical visit notes.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics v22.0 and GraphPad Prism. Demographic and summary data were presented as mean $\pm$ standard deviation for parametric data and median for non-parametric data. Student's t-test was used for comparing parametric data, and the Mann-Whitney U test was used for non-parametric data.

To determine odds ratios associated with various factors and the presentation of mixed classic-atypical TN and poor pain outcomes following surgery, chi-square analysis was performed with statistical significance ($p < 0.05$). Kaplan-Meier survival analysis was also performed based on time to recurrence of facial pain from the date of surgery and compared for significance with the log-rank test ($p < 0.05$).

Results

Mixed Trigeminal Neuralgia Patient Characteristics

Table 1 provides a profile of the overall patient demographics. A total of 73 patients with both classic and atypical TN features were included for retrospective analysis, with the mean age of the cohort being 53.2 years old (range: 24-81) and including 56 women (76.7%). There were 28 cases including V1, 59 cases including V2, and 54 cases including V3 distribution, with 34 (46.6%) patients experiencing right-sided TN pain. The mean duration of TN symptoms was 67.9 months (range: 4.0-488.3 months). The most common co-morbidities included headaches including migraines, tension, or cluster headaches (17; 23.3%), other pain syndromes including chronic fatigue syndrome and fibromyalgia (16; 21.9%), history of multiple dental procedures (7; 9.6%), and multiple sclerosis (3; 4.1%). Twenty-four patients (32.9%) received a prior procedure to treat their atypical TN, including 19 patients (26.0%) who received a previous rhizotomy, 7 patients (9.6%) who received a previous radiosurgery procedure, and one patient who received a previous MVD (1.4%). Two patients out of the 24 people who had prior interventions had received two different types of procedures previously. All patients in the cohort took antiseizure medications for pain relief preoperatively, while 8 patients (11.0%) were taking preoperative narcotics.

Fifty-five patients (75.3%) underwent an institutional TN-specific radiologic protocol. On MRI imaging, trigeminal nerve compression or contact by a vessel was found in 48 cases, with 35 cases demonstrating simple contact by an adjacent vein or artery (Grade II) and 11 cases demonstrating distortion and compression of the nerve (Grade I). All 73 cases were found to have trigeminal nerve contact or compression intra-operatively, with 61 cases (83.5%) demonstrating nerve distortion and compression by vessels or adhesions (Grade I). The sources of nerve contact are varied, including 12 cases by the superior cerebellar artery (SCA), 4 cases by the anterior inferior cerebellar artery (AICA), one case by the internal carotid artery (ICA), 5 cases by the petrosal vein, and 18 cases by adhesions.

Mixed Trigeminal Neuralgia Compared to Classic Trigeminal Neuralgia

In our retrospective database, we compared the group of 73 patients presenting with mixed classic and atypical TN with the group of 386 patients with only classic TN symptoms. All patients underwent MVD for their facial pain at the same institution.

In the group of classic TN patients, 359 patients (93.0%) had immediate postoperative pain relief or improvement (complete or partial), which is comparable to the rate of immediate postoperative pain relief or improvement for mixed TN (91.9%) ($p = 0.710$). Patients with mixed TN pain had higher odds of experiencing no pain relief (Grade IV outcome) within 1-3 months immediately postoperatively (OR [95% CI]: 2.881[1.408-5.894], $p = 0.003$) as

well as of discontinuing their pain medications by the time of last follow-up (OR [95% CI]: 1.612[1.057- 2.459], **p=0.025**) (Table 2). In addition, patients with mixed TN pain had greater odds of developing recurrence of any quality of trigeminal neuralgia pain (OR [95% CI]: 4.357[2.583- 7.348], **p<0.001**). 45 patients (61.6%) with mixed TN developed recurrence, while 77 classic TN patients (19.9%) had relapse of symptoms following MVD.

Postoperative Outcomes for Mixed Trigeminal Neuralgia

Immediate postoperative pain outcomes within 1-3 months following MVD for the group of mixed TN patients were stratified according to four grades: I being >90% pain relief with weaning of all postoperative pain-relief medications, II being >90% pain relief with minimal change in TN medications, III being <90% partial pain relief with minimal change in TN medications, and IV being no pain relief or experiencing worse pain while on medications by last follow-up. Thirty-two patients (43.8%) had grade I pain outcome, with 31 patients (42.4%) experiencing grade II, 4 patients (5.5%) experiencing grade III, and 6 patients (8.2%) experiencing grade IV outcomes (Table 3). In total, 63 patients (86.3%) experienced complete pain relief in the immediate postoperative period (Grades I-II outcomes), while 71 patients (91.8%) out of the cohort of patients with mixed TN had benefitted from MVD (Grades I-III outcomes). Of note, 31 patients (42.4%) endorsed improvement of their atypical TN pain features in addition to relief of the typical sharp, shooting pain of classic TN.

Eleven patients (15.1%) experienced facial numbness, which all resolved within 3 months after their operations. Six patients (8.2%) experienced complications post-operatively, including resolved dizziness, resolved Bell's palsy, and headaches. There was one case of a CSF leak, which was successfully managed with medication, pressure bandaging, and minimal suture placements.

All patients were prescribed medication for pain relief postoperatively (Table 4). Forty-two patients (57.5%) received anti-convulsant medications, such as oxcarbazepine, pregabalin, and carbamazepine. Fifty patients (68.5%) received postoperative narcotics, including oxycodone and hydromorphone. Three patients (4.1%) received instructions for steroid taper postoperatively as well if there may be indication of an inflammatory component to their facial pain. Twenty patients (27.4%) were eventually successfully weaned off of postoperative pain medications by last recorded follow-up.

Factors Associated with Poor Immediate Outcomes

Six patients had no pain relief (Grade IV outcome) in the 1-3 months immediately following surgery. Several factors significantly associated with a Grade IV outcome included pre-existing pain syndromes, such as chronic fatigue syndrome or fibromyalgia (OR[95% CI]: 25.455[2.704-39.636], **p<0.001**) as well as distortion of the trigeminal nerve while visualized intra-operatively (OR[95% CI]: 14.750[2.317-93.906], **p<0.001**) (Table 5). If the preoperative MRI sequence clearly identifies a vessel compressing the trigeminal nerve, the odds of not benefiting from surgery for mixed TN are lower (OR[95% CI]: 0.079[0.009-0.723], **p=0.006**).

Recurrence of Mixed Classic and Atypical Trigeminal Neuralgia

The mean length of follow-up for the cohort of mixed TN patients was 20.6 months. In the cohort of mixed TN patients, 15 patients (20.5%) were followed for at least 2 years following their MVD, while 28 patients (38.4%) had at least 1 year of postoperative follow-up. Long-term pain outcomes, defined by grades at last follow-up for the 28 patients with at least 1 year of follow-up are summarized in Table 6. Of note, 15 patients in this group (53.6%) underwent additional procedures after their initial MVD at the same institution.

Forty-four patients (60.3%) developed recurrence of either classic or atypical TN pain. The mean time to pain recurrence was 10.3 ± 11.4 months. Of note, 20 patients (27.4%) had TN recurrence of specifically sharp and shooting pain. There is a significant difference in the rate of recurrence for any type of TN pain compared with recurrence of specifically classic TN symptoms ($p < 0.001$). Of note, all patients who received grades of III or IV for postoperative pain outcome within the first 3 months after surgery eventually had pain recurrence (Table 7). There was a significant difference in the time to recurrence of any TN-type pain between the patients who did not gain pain relief (Grade IV outcome) compared to those who had complete or partial pain relief ($p < 0.001$) (Figure 1). The median time to pain recurrence for those with Grade IV outcomes was 0.59 months, while the median time to recurrence was 8.96 months for patients with Grade I-III outcomes in the immediate postoperative period.

Of note, Grade I immediate postoperative surgical outcome reflected lower likelihood of developing recurrence of any facial pain symptom (OR[95% CI]: .221[.081-.602], $p = 0.003$). However, Grade I immediate postoperative outcome did not show significance with regards to recurrence of specifically classic TN type 1 symptoms.

Nineteen patients (26.0%) eventually received additional procedures for TN management at the same institution, with 16 people choosing rhizotomies, two people undergoing radiosurgery, and one person opting for another MVD.

Discussion

Mixed TN with both classic and atypical features is difficult to treat, with higher rates of intervention failure and symptom relapse compared to patients with solely classic TN presentation. However, this study demonstrates the merit of MVD in managing mixed TN pain. In the immediate postoperative period, within 1-3 months following MVD, 91.8% of patients with mixed TN benefited from the surgery with either complete or partial improvement in classic and atypical TN symptoms. Over the follow-up period, 60.3% of mixed TN patients had relapse of facial pain, including atypical features, while just 27.4% of patients developed recurrence of specifically classic TN symptoms.

Microvascular Decompression Outcomes for Trigeminal Neuralgia with Mixed Classic and Atypical Features

Few studies have focused on mixed TN symptoms and surgical outcomes.

First of all, positive outcomes of pain relief for solely atypical TN after MVD are often cited to be lower than for classic TN. One large study on 672 patients with atypical TN found that only 47% of the group experienced complete pain relief immediately following MVD compared to 80% of the patients with classic TN.³ Even so, a majority of the group of atypical TN patients (87%) had significant pain relief immediately postoperatively.³ 79% of 56 patients with atypical TN in another prospective cohort study also experienced immediate postoperative pain relief.¹⁴ Similarly, 88.2% of a cohort of 17 patients with atypical TN presentation experienced either complete or partial pain relief from MVD.¹⁵

There is a dearth of literature investigating postoperative pain relief and MVD outcomes specifically for patients suffering from both type 1 and type 2 TN pain. A case series of 26 patients with mixed TN demonstrated significant pain relief for 80.8% of the group.¹⁶ The percentages and immediate postoperative outcomes reported in this study are reflected in our cohort's experience, where 91.8% experienced partial or complete pain relief (Grades I-III outcomes) and 86.3% of patients with mixed TN experienced complete pain relief (Grades I-II outcomes).

Some factors may predict immediate postoperative pain relief following MVD. For example, Tyler-Kabara et al. reported that memorable onset of pain onset and duration as well as discernible triggers for TN pain were associated with positive immediate postoperative outcomes for both their classic and atypical TN patient groups.³ In our cohort of mixed TN patients, we did not demonstrate a similar correlation between TN symptom duration and immediate surgical outcomes. However, we found that past medical history of other pain syndromes and clear distortion of the trigeminal nerve were significantly associated with poorer outcomes.

Trigeminal Neuralgia Pain Recurrence

Long-term pain relief is a significant outcome factor to consider for TN patients. Tyler-Kabara et al. found that 51% of atypical TN patients still retained pain relief compared to 80% of those with classic TN after 5-year follow-up.³ Likewise, 54% of patients with atypical TN had pain relief after 5-year follow-up for their primary MVD compared to 79% of their typical TN peers.¹⁴ One group identified several factors associated with long-term pain control: classic TN symptoms, evidence of trigeminal nerve compression on preoperative MRI, and obvious nerve compression intra-operatively.¹⁴ While our study did not involve follow-up for over 5 years, just examining the group of 28 patients who had at least 1 year of follow-up after MVD revealed that 15 people (53.6%) eventually sought additional procedures to relieve TN pain and 7 patients developed worsening of TN pain (Grade IV outcome) by last follow-up compared to their experience in the immediate postoperative period. These longer-term pain outcomes indicate the high difficulty in treating patients with mixed TN features.

Pain recurrence is common for TN patients, with most cases of relapse occurring within the first two years and the estimated annual pain recurrence rate at 3.5% following MVD.^{17,18} Reported risk factors for TN recurrence after MVD include female gender, left-sided TN, and duration of TN symptoms for longer than 11 years.¹⁹ On the other hand, having a

positive outcome in the immediate postoperative period is associated with good prognosis for long-term pain relief.²⁰

In investigating the rates of recurrence within our cohort of mixed TN patients, we differentiated between recurrence of any TN pain and recurrence of specifically classic TN symptoms, namely of sharp, shooting, “electrical” pain. Although no factors were found to be associated with recurrence of classic TN symptoms only, the recurrence rate of specifically classic TN features was significantly lower. This recurrence profile could reflect the higher difficulty inherent in treating atypical TN and the persistent nature of such symptoms. Thus, goals and expectations of TN management should be discussed in detail with patients with mixed TN, particularly with regards to the differences in relieving classic versus atypical TN symptoms.

Limitations

Some limitations of this study include its retrospective design and its primary focus on microvascular decompression. Retrospective chart reviews inherently are subject to numerous biases and cannot identify causation and temporal relationships between risk factors and primary outcomes. In order to minimize bias, a strict set of inclusion criteria was employed to create a patient cohort as uniform as possible despite the sample size of our cohort of patients with mixed TN. A prospective cohort study with long-term follow-up would be necessary to gain a more complete understanding of the outcomes of MVD on mixed TN. In addition, this study does not investigate the parameters and risk factors involving rhizotomy, radiosurgery or other forms of intervention for TN. Overall, this study was designed to examine characteristics of patients who presented with TN involving both classic and atypical symptoms as well as to assess the efficacy of MVD on a mixed TN presentation.

Conclusions

Within our cohort of 73 patients with mixed TN, 91.8% experienced partial to complete pain relief in the 1-3 months following MVD, including improvement in preoperative atypical TN symptoms. Patients with other pre-existing pain syndromes or gross distortion of the trigeminal nerve when visualized intraoperatively were more likely to have poor MVD outcomes. Recurrence of either classic or atypical facial pain occurred for 60.3% of the mixed TN cohort, with recurrence of specifically classic TN features at a rate of 27.4%. In contrast, the 386 patients with classic TN had a 93.0% rate of TN pain relief in the immediate postoperative period and a 19.9% rate of any TN recurrence. Mixed TN patients can benefit from MVD for short-term pain relief, with longer durations of follow-up necessary in future studies to assess for rates of and risk factors associated with recurrence.

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Abbreviations List

TN	trigeminal neuralgia
MVD	microvascular decompression

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Highlights

- Patients with mixed TN have higher rates of treatment failure and recurrence compared to classic TN.
- 91.8% of our cohort with mixed TN experienced partial to complete pain relief from MVD.
- Recurrence rate for any facial pain was 60.3% for mixed TN patients.

Figure 1:

Kaplan-Meier survival curve of time to recurrence of any facial pain for mixed TN following MVD. Grade IV outcome (n=6); Grade I-III outcome (n=67).

Table 1:

Patient demographics (n=73) of those presenting with mixed trigeminal neuralgia versus patients presenting with classic TN (n=386)

	Mixed Pain (n=73)	Classic Pain (n=386)	Total (n=459)	p values
Female	56	245	301	.051
Age (mean $\pm$ SD)	53.2 $\pm$ 12.4	53.3 $\pm$ 13.5	53.3 $\pm$ 13.3	.486
Distribution of Pain				
V1	28	145	173	.898
V2	59	287	346	.239
V3	54	258	312	.231
Duration of symptoms (mo) (mean $\pm$ SD)	67.9 $\pm$ 82.4	56.8 $\pm$ 66.3	58.4 $\pm$ 69.2	.391
<i>Previous History of Interventions</i>	24	103	127	.278
Previous Rhizotomy	19	84	103	.423
Previous Radiosurgery	7	30	37	.653
Previous MVD	1	4	5	.801
<i>Pre-operative Medications</i>	73	377	450	.188
Pre-operative anticonvulsants	73	376	449	.164
Pre-operative narcotics	8	48	56	.724
<i>Radiological and Intraop Factors</i>				
Vessel contacting nerve on MRI (Grades I-II)	48	283	331	.212
Distortion of nerve intraop (Grade I)	61	326	387	.847
Simple contact of nerve intraop (Grade II)	12	53	65	.543
No contact on nerve intraop (Grade III)	0	7	7	--

Table 2:

Table indicating MVD outcomes for mixed trigeminal neuralgia (n=73) compared to classic trigeminal neuralgia (n=386).

Factor	Odds Ratio (95% CI)	p values
Grade IV outcome	2.881 (1.408-5.894)	.003
All medications weaned by last follow-up	1.612 (1.057-2.459)	.025
Recurrence of TN1 or mixed pain	4.357 (2.583-7.348)	.001

Table 3:

Table indicating immediate (within 1-3 month) post-operative pain outcomes for mixed TN (n=73).
Classification of Pain Outcomes

- I: >90% pain relief with all discharge TN/pain medications weaned
- II: >90% pain relief with no-minimal change in discharge TN/pain medications
- III: <90% partial pain relief with no-minimal change in discharge TN/pain medications
- IV: no pain relief or worsening pain with no change in discharge TN/pain medications

Outcomes	Frequency	Percent
Grade I	32	43.8
Grade II	31	42.4
Grade III	4	5.5
Grade IV	6	8.2

Table 4:

Table indicating data regarding postoperative medication use among patients with mixed TN (n=73).

	Frequency	Percent
Post-operative anticonvulsants prescribed	42	57.5
Post-operative narcotics prescribed	50	68.5
Post-operative steroids prescribed	3	4.1
All Medications Weaned by Last Follow-up	20	27.4

Table 5:

Table indicating risk of no pain relief postoperatively (Grade IV outcome) among mixed TN patient population (n=73).

Variables	Odds Ratio (95% CI)	<i>p</i> Values
Other pain syndromes	25.455 (2.704-39.636)	.001
Vessel compressing nerve on MRI	0.079 (0.009-0.723)	.006
Distortion of nerve intraop (Grade I)	14.750 (2.317-93.906)	.001

Table 6:

Long-term pain outcomes at last follow-up for patients with follow-up time periods longer than 12 months (n=28).

Patient	Additional TN Procedure after MVD	Time after MVD for Additional Procedure (months)	Pain Outcome Grade in Immediate Postop	Pain Outcome Grade by Last Follow-up	Length of Follow-up (months)
1	Rhizotomy	11.3	II	II	21.9
2	MVD	15.3	I	III	47.6
3	Rhizotomy	9.7	I	II	26.1
4	Rhizotomy	15.1	I	II	15.9
5	Rhizotomy	28.5	II	IV	28.8
6	Rhizotomy	19.3	IV	II	24.5
7	None		I	III	35.3
8	None		II	IV	32.6
9	Rhizotomy	11.1	II	IV	30.7
10	None		I	IV	16.7
11	Radiosurgery	22.0	III	III	24.3
12	None		I	II	38.4
13	Rhizotomy	26.3	II	II	36.9
14	None		I	II	25.7
15	Rhizotomy	24.2	I	II	24.3
16	Rhizotomy	16.7	III	IV	38.9
17	None		II	IV	12.1
18	None		I	II	20.3
19	Rhizotomy	36.5	I	II	36.5
20	None		I	III	13.2
21	None		II	II	37.7
22	Rhizotomy	13.6	II	II	13.6
23	None		I	I	18.2
24	Rhizotomy	9.0	II	II	18.7
25	None		II	IV	21.8
26	None		II	III	19.3
27	Rhizotomy	10.8	IV	II	35.6
28	None		I	I	15.9

Table 7:

Recurrence of facial pain following MVD for mixed TN patients (n=73).

	Recurrence of any facial pain		Recurrence of classic TN facial pain	
	Frequency	Percent (out of each grade)	Frequency	Percent (out of each grade)
Grade I (n=32)	13	40.6	5	15.6
Grade II (n=31)	21	67.7	11	35.5
Grade III (n=4)	4	100.0	1	25.0
Grade IV (n=6)	6	100.0	3	50.0