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CLINICAL ARTICLE

The Effectiveness Posterior Fossa Partial Sensory Rhizotomy for the Treatment of Idiopathic Trigeminal Neuralgia

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Objective: Microvascular decompression (MVD) is the most effective procedure for the treatment of trigeminal neuralgia (TN). In some cases, however, there is no significant vascular compressive lesion of the trigeminal nerve during posterior fossa craniotomy, or pain relief fails despite appropriate MVD. The aim of this study is to report the efficacy of Partial sensory rhizotomy (PSR) of the trigeminal nerve at the posterior fossa in those patients with idiopathic TN.

Methods: Nine patients who underwent PSR for idiopathic TN were analyzed retrospectively. The mean age at the time of surgery was 58.0 years. The mean follow-up period was 46.3 months. Four patients without evidence of vascular compression underwent PSR only. Five patients underwent MVD with PSR because the vascular contact was insignificant. We analyzed patient characteristics, clinical results, offending vessels, and postoperative complications.

Results: Clinical outcome showed excellent results in 33.3% (3 patients), good in 33.3% (3 patients), poor in 22.2% (2 patients), and recurrence in 11.2% (1 patient) at six months follow-up after the last operation. The overall efficacy rate of MVD of TN was 84.1%. The efficacy rate after MVD with PSR was 60.0%, and performed only PSR was 75.0%. Postoperative complications were transient in 6 patients, which was facial numbness or hypoesthesia.

Conclusion: PSR at the posterior fossa for the treatment of idiopathic TN can be an alternative surgical procedure, when vascular compression is considered insignificant at operation field or MVD cannot be performed because there is no offending vessel.

KEY WORDS: Microvascular decompression · Rhizotomy · Trigeminal neuralgia.

INTRODUCTION

Trigeminal neuralgia (TN) is a severe unilateral facial electric shock-like pains which often provoked by light touch, such as eating, shaving, and talking. It is not a life-threatening disease in itself, but the severe pain and other symptoms such as anxiety and depression result in significant social disability.

TN is currently treated with various medical and surgical therapies, including microvascular decompression (MVD) when there is a significant extrinsic compression of the trigeminal nerve root with an obvious arterial component or distortion of the nerve root.

Good treatment outcome of MVD for TN depends upon the reversibility of dysfunction produced by vascular compression of the trigeminal nerve entry zone. Longer duration of symptoms leads to worse outcome. When TN is associated with a distorted nerve root, MVD does not relieve pain despite adequate vascular decompression, because a persistent intrinsic lesion is the probable cause of the disorder.[1)]

However, in some cases, there is no evidence of a significant arterial compressive lesion after posterior fossa craniotomy surgery, or the surgeon does not find a venous contact with the trigeminal nerve or lesser degrees of arterial contact with the trigeminal nerve. Partial sensory rhizotomy (PSR) may be considered as an alternative procedure in those cases. However, PSR is rarely performed for TN, because it sometimes produces intolerable dysesthesia due to nerve damage, or does not relieve pain perfectly.[2)]

For this reason, we retrospectively review and analyze surgical results of nine cases of PSR at the posterior fossa.

MATERIAL AND METHODS

Eighty-six patients who suffered from TN underwent sur-

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gery in our hospital from 1994 to 2013. Computed tomography (CT) or magnetic resonance imaging (MRI) for preoperative diagnostic workup was performed for all patients to eliminate secondary TN such as tumor.[3] All of these patients had failed non-surgical and surgical therapy, including the medication of carbamazepine and peripheral neurectomy. Seventy-seven patients underwent MVD only, and nine underwent PSR with or without MVD through a posterior fossa craniotomy. We compiled those nine patients' characteristics, clinical results, offending vessels, complications, and analyzed differences between patients who underwent PSR only and PSR with MVD.

Five patients underwent PSR with MVD at a single operation. PSR only was performed in four patients. Of those, one case was a revision operation after the first MVD that was no causative vessel, so only PSR was done.

PSR was performed with or without MVD because either it was not clear whether significant vascular compression at the trigeminal nerve root was present, or the patient had obtained good results but recurred from a prior MVD and had no significant vascular contact at the time of reoperation.

Following a posterior fossa craniotomy, cerebrospinal fluid was drained to minimize cerebellar retraction and sufficiently expose the gap between the posterior petrosal surface and the seventh-eighth cranial nerve complex. The cerebellum was retracted caudally and medially for visualization of the trigeminal nerve root entry zone. If there was no significant vascular compression with root entry zone of trigeminal nerve, PSR was performed by cutting one-third to one-half of the sensory root by cutting with micro-scissors in its lateral aspect as close as possible to the brain stem. All patients were operated same technique regardless of pain distribution. Significant vascular compression is defined as arterial contact of the trigeminal nerve root and trigeminal nerve is distorted by the result of extrinsic compression. Venous contact alone was considered insignificant.

Clinical outcome was assessed after six months from the last operation. Four groups were defined based on outcome : 1) excellent, pain free without medication ; 2) good, occasional pain controlled with or without medication ; 3) poor, severe dysesthesia, not adequately controlled with medication ; 4) recurrence, failure to control pain with return of symptoms after a remission. The cure rate was assessed as excellent outcome patient, and the efficacy rate as excellent and good outcome patient.

All the data was statistically analyzed using PASW Statistics release 21.0 (IBM Inc., Armonk, New York). Fisher exact test or Mann-Whitney U test was used in comparisons of variables data for statistical evaluation and $p < 0.05$ was considered significant.

RESULTS

The mean duration of follow-up is 46.3 months (range : 7−187 months), and the mean age of patients is 58.0 years (range : 39−82 years). Right side symptom was dominant (n=6). The duration from symptom onset to outpatient department visit was 42.2 months (range : 10−72 months). The most common pain distribution of trigeminal neuralgia was the second branch or the third branch of the trigeminal nerve (Table 1).

Five patients (55.6%) who were operated PSR with MVD group had vascular contact with the trigeminal nerve in operation field, but the vascular contact was considered insignificant, so patients underwent PSR after MVD in a single stage operation. Among these patient, the superior cerebellar artery (SCA) was in contact with the trigeminal nerve at the root entry zone in three patients. In one patient, the nerve root appeared in contact with the anterior inferior cerebellar artery (AICA). The other patient, the nerve root appeared in contact with superior petrosal vein (Table 2).

Four patients were classified as PSR only group. The three patients (33.3%) had no evidence of vascular compression or no extrinsic compression lesion with trigeminal nerve. One patient's symptom recurred, despite a successful first MVD of SCA. After eight months, this patient underwent a

Table 1. Characteristics of patients undergoing partial sensory rhizotomy at the posterior fossa

Factor	No
No. of patients	9
Gender (M : F)	1 : 8
Age (years)	
Range	39−82
Mean	58.0
Laterality of pain (Rt : Lt)	6 : 3
Pre-op pain distribution	
V2	4
V3	2
V2 & V3	3
Duration of preop symptoms (months)	
Range	10−72
Mean	42.2
Follow-up period (months)	
Range	7−187
Mean	46.3

revision operation. As there was no obvious causative vessel, PSR was performed.

There were no significant differences in duration of symptoms, operation age, or pain distribution between two groups, PSR only and PSR with MVD.

Table 2. Intraoperative findings of causative vessel and degree

Case No.	Operation mode	Intraoperative finding	State of causative vessel
1	PSR+MVD	SPV	Contact
2		SCA	Contact
3		SCA	Contact
4		SCA	Contact
5		AICA	Contact
6	PSR only	None	None
7		None	None
8		None	None
9		None	None

PSR : partial sensory rhizotomy, MVD : microvascular decompression, SPV : superior petrosal vein, SCA : superior cerebellar artery, AICA : anterior inferior cerebellar artery

Table 3. Relationship between operative procedure and patient characteristics

	PSR+MVD	PSR only	
Symptom duration (months) (mean±SD)	50.8±21.7	31.5±28.6	p=0.286
Operation age (years) (mean±SD)	60.2±15.3	55.3±15.1	p=0.643
Pain distribution			p=0.067
V2	1	3	
V3	1	1	
V2,V3	3	0	
Clinical outcome			p=0.670
Excellent	2	1	
Good	1	2	
Poor	2	0	
Recurrence	0	1	

PSR : partial sensory rhizotomy, MVD : microvascular decompression

The overall cure rate of MVD of TN in our hospital was 64.8% and efficacy rate was 84.1%, Efficacy after PSR with MVD was 60.0%, but in patients who underwent only PSR, it was 75.0% (Table 3).

No perioperative deaths or major complications occurred, including hearing loss and leakage of cerebrospinal fluid. The most common complication after PSR with or without MVD was transient facial numbness or hypoesthesia. Complication arose in four patients who underwent PSR+MVD group and two patients who underwent PSR only group. A facial spasm of short duration was presented in one patient, but it disappeared after two days. Delayed recurrence of pain within one year after operation occurred in four patients who had efficacy outcome after initial operation. Among of them, three patients were recurred in PSR only group after 6 month from operation and one patient of these three was treated with Gamma Knife radiosurgery, and symptoms subsided, but pain in the remaining two patients was controlled by medication of gabapentin. One patient suffered from recurrence after 70 months from MVD with PSR operation, but this patient's pain was controlled with medication.

DISCUSSION

Trigeminal neuralgia results from extrinsic compression of the nerve root entry zone or an intrinsic demyelinating lesion within the root.[4)5)] Typical symptoms such as "sudden brief, usually unilateral, severe, recurrent pain in the distribution of one or more branches of the fifth cranial nerve" is the most important clue of diagnosis. Preoperative MRI, especially Constructive Interference in Steady State (CISS) image helps to confirm the extrinsic vascular compression of

Table 4. Literature review of posterior fossa partial sensory rhizotomy for idiopathic trigeminal neuralgia

Author (year)	No. of patients	Mean of F/U period (months, range)	No. with MVD	Efficacy rate (%)	Recurrence rate (%)
Swanson, et al. (1981)[13)]	14	N/A (10–23)	12	100	0
Bederson, et al. (1989)[14)]	86	61 (6–192)	56	82.5	13.5
Klun (1992)[15)]	42	62 (6–144)	N/A	86	50
Young, et al. (1993)[16)]	83	84	19	70	30
Zakrzewska, et al. (2005)[2)]	60	67	N/A	88	6.7%
Koopman, et al. (2011)[17)]	39	N/A	N/A	92.3	7.7
Abhinav, et al. (2012)[18)]	47	38.7	N/A	87.2	27.5
Zhang, et al. (2012)[19)]	68	N/A	68	95.7	0
Gao, et al. (2017)[20)]	65	N/A (36–N/A)	N/A	84.6	32.3

No. : numbers, F/U : follow up, MVD : microvascular decompression, N/A : not available trigeminal nerve and check some valuable information such as epidermoid cyst, meningioma, and trigeminal schwannomas located at the cerebellopontine angle.[6] Sometimes asymptomatic vascular compressions were found in autopsies or no vascular contact was seen in some cases of patients suffering from trigeminal neuralgia at intraoperative field despite vascular contact on high resolution MRI.

In our cases, four patients suffering from trigeminal neuralgia in whom there were suspicious lesions on preoperative MRI but no significant vascular compression observed during surgery.

Vein compression is also the causative factor in TN, but is very rare. Finding of the doubtable arterial component was the most important thing, even though vein compressed on root entry zone of TN in operation field.

There are sometimes mismatches between the surgical finding and MRI. Lee, et al. reported 29 cases of MRI matched with surgical findings in 34 TN, but four cases of mismatch, and two TN caused by a venous compression.[7] When veins are the offending vessels, the vein of the cerebello-pontine fissure should be preserved, as too much sacrifice may cause venous infarction.[8)9)] Lee, et al. reported 393 cases where TN was caused by veins and treated with MVD, and pain recurred in 122 patients (31%).[10] Lee found re-growth of new veins around the nerve root after first successful MVD. The recurrence rate for TN attributable to veins is high, but TN caused by vein compression is one case in our cases. That patient was cured immediately and has an excellent and prolonged pain free outcome after vein coagulation and cutting with PSR. So for TN patients caused by veins, PSR is more suitable for treatment of TN.

The fair outcome of PSR with or without MVD in early period after operation declined 88.9% to 77.8% over six months follow-up. Three patients were recurred during first 6month and 2 cases of recurrences after 6months were recorded in patients underwent operation. The recurrence rate within the first year of patients who underwent MVD only due to TN in our hospital is lower than who underwent PSR with (6.8%) or without MVD (37.5%).

Compressive nerve lesions produce focal demyelination and nerve root distortion. Focal demyelination are found in the root entry zone in typical TN.[11] Demyelination can lead to conduction disorder of impulses that are capable of producing pain in TN. MVD has been commonly used with intolerable trigeminal pain and yields a lower recurrence than other treatments. The successful MVD of TN depends upon the reversibility of demyelination by relieving vessel compression on the nerve root, but MVD is not always effective. When adequate MVD is performed upon a distorted and demyelinated nerve root but symptoms are not relieved, it is thought that there are intrinsic lesions that will cause recurrence. PSR is an alternative treatment can be used in these cases.

PSR has now uncommonly been performed for TN because of its relative high recurrence and intolerable hypoesthesia due to nerve damage.[12] In our study, however, the clinical outcome of PSR is similar that of MVD only. We research several studies of PSR for literature review, so which show similar result to our cases (Table 4).

CONCLUSION

We analyzed nine PSR with or without MVD cases. More cases are needed for significant statistics. However, we think that PSR at the posterior fossa for the treatment of idiopathic TN can be an alternative surgical procedure, when vascular compression is considered insignificant at operation field or MVD cannot be performed because there is no offending vessel.

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