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Clinical Study

Microvascular decompression for recurrent trigeminal neuralgia

Weiting Gu [a], Weiguo Zhao [b,*]

[a] Department of Neurosurgery, Rui Jin Hospital North, Shanghai Jiao Tong University School of Medicine, Shanghai, People's Republic of China
[b] Department of Neurosurgery, Rui Jin Hospital, Shanghai Jiao Tong University School of Medicine, 197 Ruijin 2nd Road, Shanghai 200025, People's Republic of China

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ABSTRACT

Recurrence of trigeminal neuralgia (TN) symptoms after microvascular decompression (MVD) is a challenge for neurosurgeons. This study evaluates the indication, efficacy and safety of re-do MVD. We retrospectively reviewed consecutive patients who underwent MVD for TN from January 2000 to June 2012. The parameters of study interest were pre-operative magnetic resonance tomographic angiography (MRTA) findings and operative findings. Pain outcome was scored using the Barrow Neurological Institute (BNI) grading scale. Twelve patients underwent re-do MVD following recurrence of pain. Vascular compression was detected on pre-operative MRTA images in eight patients, a small mass was found in two patients, and pre-operative imaging was negative in two patients. Of the eight patients with a positive finding of arterial conflict, a vascular loop was identified intra-operatively in five patients (62.5%); in two (25.0%) a small granuloma filled with Teflon fibers was found compressed the trigeminal nerve; and in one patient (12.5%) only dense arachnoid adhesions were found around the trigeminal nerve. For the two patients with mass compression on MRTA images, a granuloma was found during operation. Neurovascular compression was found in the two patients with negative preoperative MRTA images. Re-do MVD is a safe and effective treatment for recurrent TN when indicated by a prolonged pain-free period following the first surgery.

1. Introduction

Trigeminal neuralgia (TN) is a severe syndrome characterized by episodes of facial pain. Various surgical procedures are recommended to patients refractory to medical treatment. Because of the neurovascular conflict hypothesis [1], microvascular decompression (MVD) has become one of the most common treatment options for TN [2–5]. However not all patients have a good outcome after MVD. The reported annual recurrence rate ranges from 1% to 5% [6–9]. Recurrence of TN symptoms after MVD is a challenge for neurosurgeons. The present study analyses magnetic resonance tomographic angiography (MRTA) findings and operative findings for recurrent TN and evaluates the efficacy and safety of re-do MVD.

2. Methods

2.1. Patients

We retrospectively analyzed TN patients who underwent MVD in our department from January 2000 to June 2012. Twelve patients who developed a recurrence of symptoms and required re-do MVD during this period were included in this study. Recurrent TN was defined as resurgence of TN pain, on the same side after a previous successful MVD with complete pain relief without any medication. All MVD included in this study were performed by Weiguo Zhao. The initial operative records were carefully reviewed. The severity of pre-operative pain was evaluated using the Barrow Neurological Institute (BNI) Pain Intensity Scale Score. Those who had a failed initial MVD surgery and who did not have an initial operative record were excluded from this study.

2.2. Pre-operative MRTA

All patients underwent pre-operative MRTA [10] imaging for evaluating the relationships of structures around the trigeminal nerve. MRTA was performed on a 1.5 Tesla imaging system (Signa; GE Medical Systems, Milwaukee, WI, USA). A three-dimensional time of flight spoiled gradient recalled acquisition in steady-state (3D-TOF-SPGR) sequence was carried out using the following parameters: repetition time 50 ms, echo time 6.9 ms, flip angle 30°, image matrix 256 × 256, and field of view 240 × 240 mm. The image slice thickness was 1 mm with an interslice gap of 1 mm. The bilateral oblique sagittal, coronal, and axial views were

* Corresponding author. Tel.: +86 21 6437 0045 666091; fax: +86 21 6433 3548.
E-mail address: rjzhaoweiguo@gmail.com (W. Zhao).

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obtained, and images of the vertebrobasilar system were reconstructed using maximum intensity projection, which showed the source of offending vessels. The MRTA images were evaluated independently by neurosurgeons and radiologists who were not involving in the first MVD or re-do MVD. The trigeminal nerve and surrounding vessels were carefully evaluated. "Compression" was defined as the presence of prominent hyperintense vessels in contact with the root entry zone (REZ) or the cisternal segment of the trigeminal nerve on the symptomatic side. If there was no contact with the trigeminal nerve, it was defined as "no compression" (negative).

2.3. MVD technique

As in the initial surgery, the re-do MVD was performed via a retromastoid craniotomy in the lateral position [11]. Compression was defined as nerve distortion or incisure caused by a vascular loop, or other operative findings. After the fifth cranial nerve was freed, small new pieces of Teflon felt were meticulously placed in order to separate the trigeminal nerve from the offending vessel. The anatomical details surrounding the trigeminal nerve were thoroughly recorded by a medical microscope video recorder system.

2.4. Follow-up and outcome assessment

Operative results, including immediate pain relief and complications after the re-do MVD, were assessed at discharge. All patients were followed up at the Outpatient Department. The end of the follow-up period was 31 May 2013. The follow-up period after the re-do MVD ranged from 12–97 months (mean 55.4 months). Pain outcome was also scored using the BNI grading scale. Final outcomes were obtained via telephone interviews conducted by a surgeon not involved in patient management or MVD.

3. Results

3.1. Patient characteristics

A total of 321 consecutive TN patients underwent MVD from January 2000 to June 2012. Twelve recurrent TN patients (eight women and four men) who underwent a re-do MVD in our department were included in this study (Table 1). Patient age at the time of the first surgery ranged from 26–64 years (mean 49.75 ± standard deviation [SD] 12.37 years). The duration of pain before the first MVD ranged from 1–15 years (mean 7.75 ± SD 4.22 years). All 12 patients had unilateral pain, five on the left side and seven on the right side.

The complete pain-free duration without any medication after the first MVD ranged from 0.6–10 years (mean 3.05 ± SD 2.64 years). The 12 patients underwent pharmacological treatment when pain first recurred. When their symptoms became refractory to medication, a re-do MVD was required. The re-do operation was performed from 0.8 to 12 years (mean 4.75 ± SD 3.00 years) after the first MVD.

3.2. Pre-operative MRTA

Ten patients had positive pre-operative MRTA (Table 2). Of these 10 patients with a positive result, vascular compression was detected on MRTA imaging consistent with the symptomatic side in eight, and a mass was found over the cerebellopontine angle in contact with the trigeminal nerve on the symptomatic side in two (Fig. 1). The masses were isointense on T1-weighted MRI and had low-intensity signal on T2-weighted MRI. The masses were also isointense on 3D-TOF-SPGR sequences.

3.3. Operative findings

Arachnoid adhesions were found in 10 out of the 12 patients. For the eight patients with a positive finding of arterial conflict on pre-operative MRTA images, a vascular loop was identified intra-operatively in five patients (62.5%), a small granuloma filled with Teflon fibers was found to be compressing the trigeminal nerve in two patients (25.0%), and only dense arachnoid adhesions were found around the trigeminal nerve in one patient (12.5%). Among the five patients with vascular compression confirmed intra-operatively, Teflon felt displacement was found in four patients and the offending vessel was the same as in the initial MVD, while a new vascular loop of the anterior inferior cerebellar artery (AICA) was found to be compressing the trigeminal nerve in one patient. For the two patients with mass compression on MRTA images, a granuloma was also found adhering to and distorting the trigeminal nerve REZ during surgery. Of the two patients with negative pre-operative MRTA images, neurovascular compression (vein alone) was found in one patient and a small new vascular loop (AICA) was found to be compressing the trigeminal nerve in the other patient (Table 2).

In the granuloma patients the fifth cranial nerve did not have contact with any blood vessels. The granuloma was adhered to the trigeminal nerve between an artery (one AICA and three superior cerebellar artery) and the fifth cranial nerve. The trigeminal nerve was distorted and/or had an incisure caused by the compression. A total excision of the granuloma was carried out. After the trigeminal nerve was freed, small pieces of shredded Teflon felt were meticulously placed. The pathological diagnosis was granuloma. Among these four patients, an excessive amount of Teflon

Table 1
Patient demographics and characteristics

Patient	Sex	Age at first MVD, years	Laterality of pain	Pain distribution before re-do MVD	Duration of symptoms before first MVD, years	Pain-free after first MVD, years	Time from first MVD to second MVD, years
1	F	64	L	II	15	1	5
2	F	55	R	II, III	13	2	4
3	F	54	L	II	8	4	4.2
4	F	44	L	II	4	2	2.4
5	M	52	L	I, II	8	3	4
6	M	26	R	II, III	8	1	4
7	M	42	R	III	8	3	8
8	F	29	R	II	4	10	12
9	F	51	R	III	4	2	3
10	F	57	R	I, II	7	6	7
11	M	64	L	II, III	1	0.6	0.8
12	F	59	R	III	13	2	2.6

F = female, L = left, M = male, MVD = microvascular decompression, R = right.