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A clinical analysis on microvascular decompression surgery in a series of 3000 cases

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ABSTRACT

Objective: Despite the microvascular decompression (MVD) has become a definitive treatment for trigeminal neuralgia (TN) and hemifacial spasm (HFS), not all of the patients have been cured completely so far and this sort of operation is still with risk because of the critical operative area. In order to refine this surgery, we investigated thousands MVDs.
Methods: Among 3000 consecutive cases of MVDs have been performed in our department, 2601 were those with typical TN or HFS, who were then enrolled in this investigation. They were retrospectively analyzed with emphasis on the correlation between surgical findings and postoperative outcomes. The differences between TN and HFS cases were compared. The strategy of each surgical process of MVD was addressed.
Results: Postoperatively, the pain free or spasm cease occurred immediately in 88.3%. The symptoms improved at some degree in 7.2%. The symptoms unimproved at all in 4.5%. Most of those with poor outcome underwent a redo MVD in the following days. Eventually, their symptoms were then improved in 98.7% of the reoperative patients. The majority reason of the failed surgery was that the neurovascular conflict located beyond REZ or the offending veins were missed for TN, while the exact offending artery (arteriole) was missed for HFS as it located far more medially than expected.
Conclusion: A prompt recognition of the conflict site leads to a successful MVD. To facilitate the approach, the craniotomy should be lateral enough to the sigmoid sinus. The whole intracranial nerve root should be examined and veins or arterioles should not be ignored. For TN, all the vessels contacting the nerve should be detached. For HFS, the exposure should be medial enough to the pontomedullary sulcus.

1. Introduction

Since Dandy [1] first described the compression of blood vessels on the root entry/exit zone (REZ) of the nerve as the etiology of trigeminal neuralgia (TN) or hemifacial spasm (HFS), the theory of neuro-vascular conflict has been widely accepted today. Although, there are varied treatments for TN or HFS, e.g., trigeminal rhizotomy, thermocoagulation, balloon compression, medication of Carbamazepine or Botox injections, micorvascular decompression (MVD) has become an effective treatment of TN and HFS nowadays [2], since Jannetta developed and popularized this surgical technique in the 1970s [3]. Nevertheless, this sort of the surgical process is still with risk because of the critical operative area. Moreover, until now, not all of the patients with TN or HFS could be cured by MVD completely [4–7]. With accumulation of thousands MVD cases, we have realized that the postoperative outcomes hinged largely on the surgeon's manipulation. Theoretically, the symptom of pain or spasm should stop immediately following a successful operation. We assumed that the following two main factors accounted for a failed MVD: (1) the exact offending vessel was missed or not all the offending vessels were detached from the nerve; (2) the neurovascular conflict was inapproachable as a good anatomical angle was unavailable. Basically, a satisfactory MVD has been attributed to many details, for instance, the position, craniectomy, approach and closure as well as decompression. In order to obtain better surgical results and minimize complications, every single step should not be ignored while performing the operation. In this study, we retrospectively analyzed these MVDs completed in our center with emphasis on the correlation between surgical findings and postoperative outcomes. The strategy of each surgical process of MVD was detailed.

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2. Materials and methods

From 2002 through 2011, 3000 consecutive MVDs have been performed in the department of Neurosurgery, XinHua Hospital, Shanghai JiaoTong University School of Medicine. These subjects consisted of 1282 cases of TN and 1332 cases of HFS plus 10 cases of coexistent TN and HFS as well as 42 cases of glossopharyngeal neuralgia, 5 cases of hemimasticatory spasm and 329 cases of those bilateral HFS or blepharospasm. Among them, 13 were those secondary TN or HFS caused by neoplasms. The age of the patient at the time of surgery ranged from 8 to 90 years old. The surgical data including intraoperative photos or video-recordings were registered for each case. Because of the limited number and debatable diagnosis or controversial indication, those glossopharyngeal neuralgia, secondary TN/HFS, hemimasticatory spasm, bilateral HFS or blepharospasm cases were rejected from this investigation. Four TN patients who were dead postoperatively were also excluded, which will be reported in our next paper in detail. As 9 of the 10 concurrent TN/HFS have been reported before [8], they were not addressed in this paper. Accordingly, 2601 MVDs were finally enrolled in this study.

2.1. Surgery

The patient was placed in a park bench position. The head was fixed in a Mayfield fixation frame. From 2010 on, the intraoperative abnormal muscle response (AMR) wave monitoring was adopted for HFS cases. A vertical linear incision was made behind the ear along and medial to the hairline. A craniectomy of 2.5 cm in diameter was performed in the posterior fossa. After the dura was sutured back, an operative microscope was brought into the field. Cerebrospinal fluid (CSF) was drained sufficiently to relax the cerebellum so that the operation could be performed without the use of retractors. The intracranial dissection started infrafloccularly for HFS cases, while laterocerebellarly for TN cases [8–10]. While the arachnoid membrane around the nerve was being opened, the vascular relationship was carefully studied to identify the vessels in contact with the nerve. Small pieces of shredded Teflon sponge were gently tucked in between the vessel and the nerve after the offending artery was detached from the nerve. After thoroughly irrigation to make sure there was no bleeding, the dura mater was closed with sutures in watertight pattern. A duragen was placed over the suture line. A cranioplasty of titanium wire mesh was completed. *(Refer to* Section 4 *for the detailed differences between TN and HFS.)*

2.2. Outcome assessments

Referring to the BNI score [11], the outcome was classified as excellent (symptom disappeared), good (occasional pain or spasm, not requiring medication), fair (some pain or spasm, controlled with medication) and poor (symptom remained without any improvement).

3. Results

Postoperatively, the pain free or spasm cease occurred as soon as the patient woke up from the anesthesia in 88.3% (excellent). The symptoms improved at some degree in 7.2% (good or fair). The symptoms unimproved at all in 4.5% (poor). Table 1 listed the immediate outcome in detail which was evaluated next day after the surgery. For those with poor outcome, a reoperation was performed within 2–5 days in 76 patients. Eventually, their symptoms were then disappeared or improved in 98.7% of the reoperative patients (Table 2). However, the residual 40 patients who had not undergone redo MVD did not change except for 2 HFS patients who gradually improved within 3 months. The majority reason of the first failed surgery was that the neurovascular conflict located beyond REZ for TN (Fig. 1) while the real offending artery was missed for HFS as it was far more medial than expected (Fig. 2). Sometimes, the offender was those very small vessels including veins [12]. The main complications included CSF leak (0.6%), the disturbance of hearing and balance (1%), facial palsy (1%) and hemifacial numbness (1%). The mortality was 4/3000(0.13%). Out of the 2601 patients, 998 have been finally followed up for 3 years. Among them, 15 patients of TN recurred or deteriorated, while none of the HFS patients did.

Table 1
The early postoperative outcome.

Case	No.	Excellent (%)	Good (%)	Fair (%)	Poor (%)
TN	1274	1095 (86.0)	42 (3.3)	74 (5.8)	63 (4.9)
HFS	1327	1201 (90.5)	35 (2.6)	38 (2.9)	53 (4.0)
Total	2601	2296 (88.3)	77 (2.9)	112 (4.3)	116 (4.5)

TN, trigeminal neuralgia; HFS, hemifacial spasm.

Table 2
The outcome after the reoperation.

Case	No.	Excellent	Good	Fair	Poor
TN	46	38	4	3	1
HFS	30	27	2	1	0
Total	76	65	6	4	1

TN, trigeminal neuralgia; HFS, hemifacial spasm.

3.1. Trigeminal cases

Among the 1274 cases of trigeminal neuralgia, the offending vessels were observed as artery only, artery combined with vein and vein only, respectively. Frequently, more than one offending vessel was found (74%), which included superior cerebellar artery (SCA, 41%), anterior inferior cerebellar artery (AICA, 29%), petrosal vein(s) (35%), posterior inferior cerebellar artery (9%) and vertebral artery (VA, 6%).

The conflict site was observed at the REZ (where the nerve enters the pons) in 54.8%, at the middle root in 36.2% and at lateral root (where the nerve comes from Meckel's cave) in 9.0%. The neurovascular conflicts were noticed as the following fashion with the relationship of the vessel(s) and the nerve: (1) contact in 22%, (2) impress in 26%, (3) adhesion in 40% and (4) penetration in 12%.

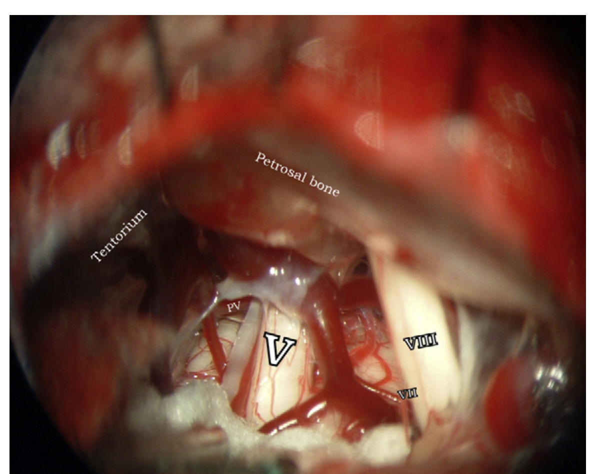

Fig. 1. The offender may locate at any site of the nerve root. In this case, the offender is a petrosal vein (PV) located ventrally to the later trigeminal nerve root (V). VII: facial nerve; VIII: vestibulecochlear nerve.