Microvascular Decompression for Trigeminal Neuralgia: The Role of Mechanical Allodynia

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OBJECTIVE: **This study was conducted to determine whether mechanical allodynia (MA) acts as a predictor of outcome after microvascular decompression (MVD) for trigeminal neuralgia (TN) and to discuss the potential pathologic mechanisms involved.**

METHODS: **A series of 246 patients who underwent MVD for TN were involved in the study. The classifications were based on the characteristic of pain (shocklike or constant), and the presence of MA was defined from the chart review, retrospectively. Surgical outcomes are defined as excellent, good, or poor. Immediate and long-term outcomes were compared to provide the information on recurrence and delayed relief. The relationship among the groups was investigated, and the strength was determined.**

RESULTS: **The presence of MA and the type of TN pain are significant predictors of surgical outcome ($P < 0.05$). MA was proved to be an independent predictor of surgical outcome and a significant predictor of existence of neurovascular compression ($P < 0.05$) and lower rate of recurrence ($P < 0.05$). No statistically significant predictors of delayed relief were detected in this study.**

CONCLUSIONS: **The presence of MA is a reliable predictor of immediate and long-term outcome after MVD for TN. Compared with the patients without MA, the incidence rate of intraoperative neurovascular compression was higher in MA-positive patients, who were more likely to achieve a better outcome and lower rate of recurrence after MVD for TN. Application of the information in this study will be helpful in patient selection of MVD for TN.**

INTRODUCTION

Since Dandy[1] first proposed the vascular compression of the trigeminal nerve as the cause of trigeminal neuralgia (TN)[1] and Jannetta successfully developed and popularized microvascular decompression (MVD) to manage the pain,[2] the theory of neurovascular compression (NVC) has been generally accepted. Although there are other treatments for TN (e.g., medications such as carbamazepine or botulinum toxin [Botox], gamma knife radiosurgery, and percutaneous therapies, including radiofrequency thermocoagulation, balloon compression, and glycerol rhizotomy), MVD is ranked as the most effective remedy for TN.[3] Nevertheless, not all patients can be completely cured by MVD, and recurrence or delayed relief can occur in a small proportion of patients.[3-5] Some patients with refractory pain go through a series of medical treatments and eventually fail to achieve any pain relief. This dilemma reflects the lack of a thorough understanding TN mechanisms, which are considered a unique form of neuropathic pain[6] and the most common type of neuralgia.[7]

TN is a facial pain syndrome characterized by paroxysmal, shocklike pain attacks located in the somatosensory distribution of the trigeminal nerve.[8] It has been traditionally divided into typical and atypical forms according to the presence of episodic pain attacks, trigger points, and long pain-free intervals, for example.

Key words
- Microvascular decompression
- Mechanical allodynia
- Neurovascular compression
- Pathologic mechanism
- Trigeminal neuralgia

Abbreviations and Acronyms
CI: Confidence interval
MA: Mechanical allodynia
MVD: Microvascular decompression
NVC: Neurovascular compression
OR: Odds ratio
T1TN: Type 1 trigeminal neuralgia
T2TN: Type 2 trigeminal neuralgia
TN: Trigeminal neuralgia

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Better outcomes are more likely to be achieved in patients with typical TN.[9,10] Recently, a new classification,[11] in which the type of pain (shocklike pain vs. constant pain) is isolated as the base of categorization, was proposed and later reported to act as a predictor of long-term outcome after MVD.[12] In this study, we allowed for the fact that there are too many factors to be taken into account in the traditional classification, and the underlying mechanisms had become too equivocal to be explored as a result. Therefore, we extracted one of the characteristics of typical TN descriptions—mechanical allodynia (MA), which is a hallmark of neuropathic pain—as the base of classification to evaluate its effect in predicting the outcome after MVD.

In this retrospective study, we evaluated the effect of MA in predicting the outcome after MVD and compared it with that of the TN pain type. The underlying mechanism was also discussed.

MATERIALS AND METHODS

We retrospectively reviewed a series of 254 patients who underwent MVD for TN performed by the senior author (W.Z.) from January 2010 to June 2013. The classifications were based on the type of pain (shocklike or constant) and the presence of a trigger point (i.e., MA), and they could be defined from the medical history charts. Intraoperative findings, including the presence of NVC, were obtained from the operation videos. Every patient was contacted via telephone by an interviewer who was blinded to the classifications and immediate outcome of patients. Interviewers inquired about the patients' long-term outcomes, including pain relief, the characteristic of residual pain, the presence of a trigger point (i.e., MA), and unusual sensations. The combination of immediate and long-term outcomes could provide information on recurrence and delayed relief.

Patients with TN in our institution might undergo more than 1 operation to achieve a satisfactory outcome. Rigorous exploration and decompression of the trigeminal nerve was performed in every operation. Those who still experienced pain after MVD were advised to accept a second MVD, in which we would perform the internal neurolysis after reviewing the operation videos and ensured no vascular compression. Internal neurolysis would be performed in the first MVD when there were no signs of NVC. Radiofrequency lesioning is another frequent choice for patients with refractory pain following a second MVD or a first MVD during which no NVC was observed. Only those who underwent MVDs but not radiofrequency lesioning were included in this study.

Three groups were defined on the basis of outcome: 1) excellent, total pain relief without medication; 2) good, pain controlled with low-dose medication; and 3) poor, persistent pain remained nearly unchanged.[12]

Statistical analyses were performed using SPSS 18.0 for Windows. The χ^2 test was applied for contingency tables, with $P < 0.05$ considered significant. Odds ratio (OR) and its 95% confidence interval (CI) were used to detect the strength of relation. This study was approved by the Xinhua Hospital Medical Ethics Committee.

RESULTS

We lost contact with 8 patients during the follow-up period. A total of 246 patients (74 males and 172 females, with a mean age of 63 years) were involved in this study. Demographic and clinical characteristics of patients are summarized in Table 1. There was a predominance of female and right side in TN. MA is present in the majority of patients, most of which is classified as type 1 TN (T1TN) (86.2%), and also with NVC (79.8%). Patients with MA were more likely to be detected with the presence of NVC involved ($P = 0.001$; OR, 2.79; 95% CI, 1.48–5.24), whereas there is no statistically significant relationship between the presence of MA and T1TN ($P = 0.21$; OR, 1.63; 95% CI, 0.76–3.47).

Overall, the immediate outcome after MVD according to the chart review is as follows: 130 (53%) patients with excellent outcome, 60 (24%) patients with good outcome, and 56 (23%) patients with poor outcome (Table 2). The long-term outcome was evaluated using the telephone interview. Using a combination of immediate and long-term outcomes, the recurrence was defined as "from good to poor" or "from excellent to good or poor," and the delayed relief was defined as "from good to excellent" or "from poor to good or excellent." The overall rate of recurrence and delayed relief was 13% and 8%, respectively.

Table 1. Demographic and Clinical Characteristics of 246 Patients*

Characteristics	MA (n = 188)	NMA (n = 58)
Mean age (years)	62.7	63.9
Female sex (%)	132 (70.0)	40 (69.0)
Mean duration (months)	64.5	80.9
Right side (%)	110 (58.5)	30 (51.7)
History of hypertension	86	22
History of DM	24	0
T1TN (%)	162 (86.2)	46 (79.3)
NVC (%)	150 (79.8)	34 (58.6)
Mean postoperative follow-up (months)	43.1	42.4

MA, mechanical allodynia; NMA, non-MA, absence of mechanical allodynia; DM, diabetes mellitus; T1TN, type 1 trigeminal neuralgia; NVC, neurovascular compression.
*Values represent numbers of patients (%) unless otherwise indicated.

Table 2. The Results of Immediate Outcome After Microvascular Decompression

Classification	Excellent	Good	Poor
MA (n, %)	115 (61)	42 (22)	31 (17)
NMA (n, %)	15 (26)	18 (31)	25 (43)
T1TN (n, %)	120 (58)	48 (23)	40 (19)
T2TN (n, %)	10 (26)	12 (32)	16 (42)

MA, mechanical allodynia; NMA, non-MA, absence of mechanical allodynia; DM, diabetes mellitus; T1TN, type 1 trigeminal neuralgia; T2TN, type 2 trigeminal neuralgia.