Long-term efficacy of microvascular decompression in trigeminal neuralgia

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Forty patients were followed for an average period of 8.5 years after 44 consecutive suboccipital craniotomies for trigeminal neuralgia. Among these patients, 36 had microvascular decompression (MVD) of the nerve, four had repeat trigeminal rhizotomy after MVD was not successful in controlling their pain, and four had primary trigeminal rhizotomies. Of the 36 patients undergoing MVD, 17 (47%) experienced recurrent postoperative neuralgic pain: in 11 (31%) pain recurrence was major, and in six (17%) it was minor. Among the eight patients undergoing rhizotomy, four (50%) had major pain recurrences and one (13%) had a minor recurrence, for a 63% total recurrence rate. There was a strong statistical relationship between an operative finding of arterial cross-compression of the nerve and long-term complete pain relief. Patients with other compressive pathology (related to veins or bone structures) did not on the average fare as well. Despite this, there appeared to be no point in time in the postoperative interval when the patient could be considered “cured.” Major recurrences averaged 3.5% annually, and minor recurrences averaged 1.5% annually. The implications of these findings for the treatment of trigeminal neuralgia and the current understanding of the mechanism of MVD for this disorder are discussed.

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tacted directly. In the event of a patient dying since the last follow-up examination, a detailed history of the patient's neuralgia and postoperative course was obtained from a family member.

The patients were divided into three groups. Group 1 included those who had been continuously pain-free since surgery without any antineuralgia medication, such as carbamazepine, phenytoin, or baclofen. Group 2 comprised patients with minor recurrence of their neuralgic pain (transient, infrequent, or mild pain) that did not require medication or was controlled by medication alone. Group 3 included patients with major recurrence of typical neuralgic pain. Patients considered to be in the latter group did not achieve pain control with medication, had severe pain similar in intensity to their preoperative status, and usually sought and underwent further surgical procedures.

Other factors such as persistent facial sensory loss or dysesthesias, massteric weakness, and the nature and dates of subsequent surgery were also documented. Statistical analysis was performed by 2 × 2 chi-square testing.

**Results**

All 40 patients were accounted for in this retrospective review (100% follow-up data). Two patients died of causes unrelated to either their operation or their trigeminal neuralgia at 3 and 5 years postoperatively. For statistical purposes, these patients were considered to be lost to follow-up review at the time of their death. Including these deceased patients, the follow-up interval averaged 8.54 ± 1.37 (mean ± standard deviation) years and ranged from 7.5 to 11.5 years.

Seventeen (47%) of the 36 patients undergoing MVD experienced recurrent neuralgic pain during the follow-up period. Eleven (31%) had major recurrences, and six (17%) had minor recurrent pain. Among the eight patients undergoing rhizotomy, four (50%) had major pain recurrences and one (13%) had a minor recurrence, for a 63% total recurrence rate. The remainder of the results presented here concern only the MVD patients.

Figure 1 shows the Kaplan-Meier probability curve for a pain-free state, for minor pain recurrence, and for major pain recurrence in the patients after MVD. At the average follow-up interval of 8.5 years, 58% of patients were completely pain-free, 12% had experienced a minor recurrence, and 30% had a major pain recurrence. If the pain-free patients plus those with a minor recurrence were considered to have had a good result, then 70% of these patients had persisting acceptable relief 8.5 years after MVD.

Fifteen (79%) of the 19 patients who remained pain-free after MVD were found to have arterial cross-compression of the nerve at surgery, while in only six (55%) of 11 patients with major pain recurrence was an arterial neurovascular contact identified. The finding of an arterial cross-compression of the trigeminal nerve at the time of the original surgery was inversely related to the incidence of a major recurrence (chi-square = 13.03, df = 1, p < 0.0005), but interestingly was not related to the incidence of a minor recurrence (chi-square = 0.5190, df = 1, p < 0.5). Six (24%) of 25 patients in whom arterial impingement on the nerve was identified had major pain recurrence, while four (57%) of seven patients with venous compression of the nerve had a similar major recurrence. This indicates that patients with venous pathology were significantly more likely to experience a major pain recurrence (chi-square = 22.59, df = 1, p < 0.0005).

Facial sensory loss after MVD, discovered in nine patients by careful testing immediately after surgery, did not correlate with recurrence of pain in any way. Furthermore, neither the nature of the surgical findings (artery, vein, or bone compression) nor the presence or absence of a postoperative sensory loss related in a significant way to the latency of pain recurrence, if any.

A history of prior neurodestructive surgery (gangliectomy, neurectomy, alcohol block, or rhizotomy) was present in 10 (59%) of 17 patients who experienced pain recurrence, and in 11 (58%) of 19 who had recurrent pain (chi-square = 0.021, df = 1, p < 0.9). Five (46%) of 11 patients with major pain recurrence had a prior destructive procedure which, in comparison to the patients with no pain recurrence, was not significant (chi-square = 3.36, df = 1, p < 0.1). This trend indicated, if anything, that prior surgery was a favorable prognostic indicator for long-term pain remission. However, minor recurrences of pain were significantly related to prior destructive procedures (chi-square = 15.02, df = 1, p < 0.0005).

**Discussion**

Long-term follow-up data on the efficacy of MVD for trigeminal neuralgia is lacking in published series. Virtually all well-documented reports in the literature have a postoperative follow-up period of less than 5 years. However, more than half of the patients who recurred in this study had a follow-up period of more than 5 years.
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years,\textsuperscript{13,16,18} and the vast majority average 3 years or less.\textsuperscript{1,6-8,15,17,20-22} Interestingly, the figure of 80% “long-term” success is a recurring theme in these reports, which is almost precisely the result that would be predicted at 3 to 5 years from our follow-up data (Fig. 1).

Taarnhøj\textsuperscript{9} presented 30-year follow-up data on a series of patients with trigeminal neuralgia from a variety of etiologies (compression by tumors, arteries, veins, angiomas, and an elevated petrous ridge), who underwent decompression of the trigeminal nerve via middle fossa or posterior fossa approaches. Two-thirds of this group was operated on early in this series via the middle fossa route, and compressing arteries were found and decompressed only 3% of the time. Later in this experience, with a shift to a microsurgical posterior fossa approach the relief rate of arterial pathology increased to 45%. The total follow-up period for the entire series averaged 11.5 years. However, this average was clearly biased by the majority of these patients in whom MVD, as it is conceived presently, was not performed. Segregating out those patients in Taarnhøj’s series treated with a posterior fossa microsurgical approach since 1971, it was stated that 80% have remained free of pain. The average follow-up interval for this subgroup was not given.

The present series has some advantages over other reports in that a single group of patients operated on during a short interval (1976–1979) has been surveyed. The overall “success” rate of this group is not biased by a large number of patients with relatively short follow-up periods, as has been the case in other reviews. Patients operated on for trigeminal neuralgia with MVD since 1979 were not included in this review to avoid this potentially misleading distortion of the data.

Unquestionably, the largest experience with MVD for trigeminal neuralgia is that of Jannetta.\textsuperscript{9-12} His latest results\textsuperscript{10} indicate that approximately 80% of patients can expect permanent relief of pain, and that good but not total relief of pain will be achieved in another 10%. From the descriptions of the extraordinary success of this series, it is not possible to ascertain the follow-up period or the progression of recurrences over time. Jannetta has indicated that a patient who remains pain-free for a year postoperatively will probably not have recurrent pain. Indeed, in his hands an earlier review of 450 cases showed only two patients to have recurrent pain after 1 year (11% after one operation and 7.4% after two), the majority recurring within 6 months.

In contradistinction to prior reports, our results imply that MVD does not “cure” trigeminal neuralgia, but simply arrests it for a prolonged period. Analysis of our data indicates that the chance of a major recurrence of trigeminal neuralgia after MVD is approximately 3.5% annually. The risk of minor recurrence is 1.5% annually, or about two to three times less than the risk of major recurrence. There appears to be no time beyond which a pain recurrence is less likely, in that there seems to be a progressive erosion of the number of pain-free patients over time. If our data are extrapolated, it would indicate that MVD has a “half-life” of about 10 years for the pain-free state, and approximately 14 years for a good result (pain-free plus minor recurrence). For the elderly patient, this prolonged remission may equate with a “cure” from the pain during their lifetime. However, in younger patients, late recurrences would be predicted.

According to one study, a history of prior neurodestructive surgery may influence outcome from MVD, reducing the expectations of a good result to the range of 50%.\textsuperscript{2} Our outcome analysis did not support this contention in that, as a group, patients with prior neurodestructive operations fared as well as or better than patients without a prior surgical history. When major and minor recurrences were separated, it was clear that major recurrences did not correlate with prior surgery, while minor recurrences did.

The small number of patients who underwent rhizotomy in this series fared less well than those with MVD: 50% of rhizotomy patients had a good result at the average follow-up period in contrast to 70% of MVD-treated patients. Again, in this group major recurrences were much more common than minor recurrences.

One of the most interesting findings of this review was that the absence of the finding of arterial cross-compression at the time of MVD did not bode well for the long-term success of the procedure. Our earlier report and other series\textsuperscript{13} have noted this trend, and long-term follow-up data confirm this relationship to outcome. Patients with decompression of an artery in contact with the nerve have a significantly greater chance of long-term remission than do patients in whom relief of nonarterial compression is carried out.

A skeptical observer might submit that the manipulation and trauma to nerve implicit in the performance of MVD may underlie the efficacy of the procedure. Several aspects of our data argue to the contrary. First, while postoperative facial sensory loss is not a prominent feature after MVD, with careful testing approximately 25% of our patients had some degree of hypesthesia. Sensory loss would be one indicator of the degree of neural trauma. Yet, this mild sensory loss did not relate in a significant way to either the incidence of, or latency to recurrence of pain in our patients. Secondly, in our experience, the degree of mechanical neural trauma incurred by decompression of a vein or bone prominence from the nerve typically exceeds that produced by arterial decompression. Patients with nonarterial pathology fared less well in our hands, and therefore potentially increased neural manipulation in this group did not appear to have a beneficial effect. Lastly, patients with frank rhizotomy suffered recurrence sooner than did those with MVD. The rate of sensory loss after rhizotomy was, of course, 100%. Sensory loss after MVD was very mild and only occurred in 25% of our patient group. Thus, our evidence indicates that the efficacy of interposition of an inert sponge between the nerve and the compressive structure, particularly when
the offending agent is arterial, does not appear to depend on gross neural trauma induced at the time of surgery.

Trigeminal neuralgia is a persistent disorder, regardless of the medical or surgical treatment employed. Fortunately, there are a number of highly effective surgical modalities available to those patients not manageable by pharmacological means. Microvascular decompression is one of our most powerful weapons against this disorder. However, we must bear in mind that the mechanism of trigeminal neuralgia remains unknown. Likewise, the mechanism by which MVD produces long-term remission from these pains may not conform to our current understanding of the operation's mode of action.

References
17. Swanson SE, Farhat SM: Neurovascular decompression with selective partial rhizotomy of the trigeminal nerve for tic douloureux. Surg Neurol 18:3-6, 1982

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