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diopathic trigeminal neuralgia (TN) is a disabling dis-
order characterized by sudden attacks of unilateral
facial pain. Microvascular decompression (MVD) is
the method of choice to definitively cure the condition
if medical treatment fails to provide sufficient relief. Al-
though the success rates of MVD tends to reduce over
time, in the majority of patients (up to 70%) long-term
relief (10–15 years) can be achieved with minimal mor-
bidity and mortality.2,10 This also implies that a signifi-
cant proportion of patients suffers recurrent TN after MVD, a
clinical condition that requires careful decision making
with respect to additional treatment. Often, these patients
are offered neurodestructive procedures—for example,
glycerol injection, Sweet thermocoagulation, or stereo-
tactic radiosurgery.6,8,9 Although these procedures often
provide relief in the short term, their long-term results
can be disappointing, with success rates of 40%–50%.5

Moreover, if these ablative procedures are performed
repeatedly, patients are at risk for facial numbness.3,7
Repeat MVD is a feasible alternative for recurrent TN,
even after neurodestructive procedures, but the literature
reports lower success rates and higher complication rates
for repeat MVD than for primary MVD.1,2,4 Especially
facial numbness is a commonly encountered problem.2
Also, careful patient selection for repeat MVD is con-
sidered to be crucial, but little is known of risk factors
with respect to treatment outcome. In this paper, we de-
scribe our experience with a large series of patients who
underwent repeat MVD for recurrent TN with regard to
outcome, risk factors, and complication rates.

Methods

Between January 1990 and April 2013 a cohort of
376 consecutive patients underwent primary MVD for
idiopathic TN at the University Medical Center Gronin-
gen. A repeat MVD was performed in 29 of these patients

Abbreviations used in this paper: MVD = microvascular decom-
pression; TN = trigeminal neuralgia.
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(7.7%). In addition, 4 patients who were initially surgically treated at another institution underwent repeat MVD at our center. According to institutional board regulations, informed consent was not necessary for this study.

Follow-Up

A retrospective chart review was performed, and the following information was collected: 1) age (at time of repeat MVD); 2) sex; 3) side of TN; 4) duration of pain before first MVD; 5) intraoperative findings of first and repeat MVD; 6) time to recurrence after first MVD; 7) additional neurodestructive procedures; 8) results of first MVD (pain-free interval, yes/no); 9) time between first and repeat MVD; 10) divisions of trigeminal nerve involved; 11) type of pain (typical/atypical); and 12) occurrence of complications. As part of the treatment protocol, patients were contacted by telephone in a standardized manner 1 year after surgery to investigate outcome. The variables assessed in this interview were presence of facial pain, trigeminal nerve function, and medication use related to TN. Success after 1 year was defined as the presence of < 25% of the preoperative pain and/or the use of ≤ 600 mg carbamazepine.

Operative Procedure

The intent of surgery was to decompress the trigeminal nerve. If no evidence of compression was present, the Teflon felt was removed, and it was replaced if necessary. In some cases, an extensive neurolysis was also performed. After 2005, such neurolysis was abandoned because of poor results in terms of sensory loss.

Statistics

Continuous variables were expressed as mean with standard deviation or median with range, and categorical variables as counts and percentages. Risk factors (odds ratios [ORs]) were analyzed by univariate binary logistic regression analysis. All factors with a p value < 0.10 after univariate analysis were considered in the multivariate model using a backward elimination strategy. A p value < 0.05 mm was considered to indicate statistical significance. Missing data were censored in all analyses. All data analyses were performed with the Statistical Product and Service Solutions (SPSS) version 20.0.

Results

Patient Characteristics

The sex of the patients who underwent repeat MVD was evenly distributed (52% male) (Table 1). The median age at the time of repeat MVD was 58 years (range 21–76 years). Also, the side of the TN was evenly distributed (49% right side). The majority of patients had involvement of the maxillary and/or mandibular root. In 23 (79%) of 29 patients, a pain-free interval after the first MVD was observed, with a median duration of 5 months (range 1 months–6.5 years). The median time between first and repeat MVD was 24 months (range 7 months–14 years). Most exhibited typical TN pain preceding the first as well as the repeat MVD (91% and 94%, respectively). Eight patients (24%) underwent neurodestructive procedures, either before the first MVD or between the surgeries.

Operative Findings

Operative findings of the first MVD were available in 28 of 33 patients (Table 2). During the initial MVDs an arterial compression on the trigeminal nerve was present in 20 operations (71%), while venous compression was encountered in 3 procedures (11%). During 5 operations (18%) a combined neurovascular conflict was present. In 5 of the 33 repeat MVDs (15%) a new arterial compression was found, while new venous compression was present in 6 operations (18%). In 2 patients (6.1%), a new combined neurovascular conflict was present. In 20 patients (61%) no vascular compression was encountered. In 16 of these patients (49% of the overall group), the Teflon felt was removed because of a (developing) granuloma. In 2 patients (6.1%), a partial transection of the trigeminal nerve was performed.

Outcome and Risk Factors

At 12 months' follow-up 22 operations (67%) were successful; in 19 of these 22 cases, the patients were completely free of pain without the use of medication. On univariate analysis, significant risk factors for success were
older age (OR 1.11, p < 0.01) and direct absence of pain after the surgery (OR 25.2, p < 0.01). In a multivariate model, both factors remained statistically significant (p < 0.01), with odds ratios of 12.1 and 1.08 for a pain free interval and older age, respectively (Table 3). Additional neurodestructive procedures did not influence success rates. Operative findings (Table 2) were not associated with outcome (data not shown).

Complications

Nine patients (27%) suffered from facial numbness after repeat MVD (Table 4). Hearing loss occurred in 1 patient (3.0%). No patient died.

Discussion

The results of this study demonstrated that repeat MVD was successful in 67% of the patients after 1 year. This success rate is comparable with rates reported in previous studies.\textsuperscript{1,2,4} Although success rates are somewhat lower than after primary MVD, still a significant proportion of patients clearly benefit from repeat MVD. Patient selection is crucial in deciding whether the patient should be offered a repeat MVD. In our opinion, patients should have had a pain-free interval after initial MVD, irrespective of the duration, and the TN should be typical. In cases of atypical pain, patients are referred to stereotactic radiosurgery. Imaging is not considered a crucial factor in patient selection. MRI studies are merely performed to exclude potential complications from the first MVD. Excellent results have been achieved in patients who did not have clear evidence of neurovascular conflict on MRI.\textsuperscript{2}

New paresthesias or numbness was encountered in 9 patients (27%). Facial numbness is a frequently encoun-

### TABLE 2: Operative findings and successful outcomes

<table>
<thead>
<tr>
<th>1st Op</th>
<th>2nd Op</th>
<th>No. of Patients</th>
<th>No. of Successful Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>arterial compression</td>
<td>arterial compression</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>venous compression</td>
<td>venous compression</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>arterial &amp; venous compression</td>
<td>arterial &amp; venous compression</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>removal of Teflon</td>
<td>removal of Teflon</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>partial nerve section</td>
<td>partial nerve section</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>venous compression</td>
<td>venous compression</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>arterial &amp; venous compression</td>
<td>arterial &amp; venous compression</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>removal of Teflon</td>
<td>removal of Teflon</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>findings unavailable</td>
<td>venous compression</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>arterial &amp; venous compression</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>removal of Teflon</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

### TABLE 3: Logistic regression analyses\textsuperscript{a}

<table>
<thead>
<tr>
<th>Factor</th>
<th>OR</th>
<th>95% CI</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>univariate analyses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>older age (yrs)</td>
<td>1.11</td>
<td>1.03–1.20</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>male sex</td>
<td>1.44</td>
<td>0.34–5.16</td>
<td>0.62</td>
</tr>
<tr>
<td>typical pain</td>
<td>4.67</td>
<td>0.37–58.2</td>
<td>0.23</td>
</tr>
<tr>
<td>involvement of ophthalmic nerve</td>
<td>0.42</td>
<td>0.07–2.55</td>
<td>0.35</td>
</tr>
<tr>
<td>involvement of maxillary nerve</td>
<td>0.59</td>
<td>0.10–3.57</td>
<td>0.57</td>
</tr>
<tr>
<td>involvement of mandibular nerve</td>
<td>0.66</td>
<td>0.13–3.21</td>
<td>0.60</td>
</tr>
<tr>
<td>previous neurodestructive treatment</td>
<td>1.69</td>
<td>0.28–10.2</td>
<td>0.57</td>
</tr>
<tr>
<td>duration btwn 1st &amp; 2nd op (mos)</td>
<td>1.00</td>
<td>0.98–1.02</td>
<td>0.99</td>
</tr>
<tr>
<td>pain-free interval after 1st op</td>
<td>1.52</td>
<td>0.33–7.15</td>
<td>0.59</td>
</tr>
<tr>
<td>time to recurrence after 1st op (mos)</td>
<td>1.06</td>
<td>0.99–1.15</td>
<td>0.12</td>
</tr>
<tr>
<td>direct success after 2nd op</td>
<td>25.2</td>
<td>2.45–259</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>multivariate analysis\textsuperscript{f}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>direct success after 2nd op</td>
<td>12.1</td>
<td>1.01–144</td>
<td>0.05</td>
</tr>
<tr>
<td>older age (yrs)</td>
<td>1.08</td>
<td>1.00–1.16</td>
<td>0.07</td>
</tr>
</tbody>
</table>

\textsuperscript{a} With success after 12 months as the dependent variable.

\textsuperscript{f} Multivariate analysis with a backward removal strategy; p < 0.01 for the overall model.
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TABLE 4: Complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>No. of Cases (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>mortality</td>
<td>0</td>
</tr>
<tr>
<td>CSF leakage</td>
<td>1 (3.0)</td>
</tr>
<tr>
<td>paresthesia</td>
<td>9 (27.3)</td>
</tr>
<tr>
<td>hearing loss</td>
<td>1 (3.0)</td>
</tr>
</tbody>
</table>

tered phenomenon after repeat MVD. Amador and Pollock\(^1\) reported facial numbness in 52% of patients, while Barker et al.\(^2\) mention severe facial numbness in 8.3% of their surgically treated patients. Interestingly, after a thorough retrospective review of the surgical procedures in our cases, it appeared that in these patients an extensive neurolysis of the trigeminal nerve was performed. Because of these findings, such an extensive procedure was abandoned in 2005. As a result, none of the patients who underwent surgery after 2005 (n = 11) suffered from facial numbness after surgery, while the results on pain relief were comparable. We therefore advocate performing a limited neurolysis, with removal of the Teflon felt in case of a close anatomical relation with the trigeminal nerve. In our experience, the compressing vessel that was initially involved in the trigeminal neuralgia does not return to the original site of compression after removal of the Teflon felt. Based on our series, we speculate that the Teflon felt—even in the absence of a (developing) true granuloma—might be involved in the pathogenesis of recurrent TN, as complaints are often diminished after removal of the Teflon felt.

This study identified 2 factors—increasing age and immediate relief of pain after surgery—that showed a positive influence on success rates. These factors are known from previous studies,\(^1,2,4\) indicating that our study group is a representative sample of patients with TN. Nevertheless, some study limitations have to be addressed: the retrospective design, change of treatment over time, and the long study time frame with a relatively short follow-up period preclude drawing any firm conclusions regarding risk factors and outcome. Also, interviews by telephone may lead to a recall bias, especially because of the subjective nature of the pain.

Conclusions

This study confirms that repeat MVD is a feasible therapeutic option with good chances of success and low complication rates, even after neurodestructive procedures. Therefore, for patients refractory to other treatments, we strongly encourage looking upon repeat MVD as a feasible therapeutic option. Complication rates, particularly facial numbness, can be avoided if only a limited neurolysis is performed.

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author contributions to the study and manuscript preparation include the following: Conception and design: Bakker, Van Dijk. Acquisition of data: Bakker, Immenga, Wagemakers, Metzemaekers. Analysis and interpretation of data: Bakker, Van Dijk, Immenga, Wagemakers. Drafting the article: Bakker, Van Dijk. Critically revising the article: all authors. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Bakker. Statistical analysis: Bakker, Immenga. Study supervision: Metzemaekers.

References


Disclosure


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