ENDOSCOPIC VASCULAR DECOMPRESSION OF THE TRIGEMINAL NERVE

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ABSTRACT

For more than 7 years (from May 2004 till October 2011), 40 patients underwent endoscopic vascular decompression (EVD) of the trigeminal nerve. These patients' records were retrospectively reviewed, and additional data from follow-up visits was collected and analyzed to ascertain success rates and review the incidence of complications. From a total of 40 patients who underwent EVD of the trigeminal nerve we noted an initial, (first 3 months), complete postoperative success rate in 92.5% of patients. A three-year follow-up period documented a 93% complete success rate for 20 patients who completed follow-up. There were no serious complications or mortality.

Keywords: Endoscopic, microvascular decompression, trigeminal neuralgia, facial pain.

INTRODUCTION

Trigeminal neuralgia is a disease characterized by severe and often debilitating facial pain that occurs along the distribution of any of the three branches of the trigeminal nerve. As classically defined, attacks are intermittent and the quality of the pain is sharp, stabbing, or mimicking an electric shock. The mainstay of treatment for patients with trigeminal neuralgia prior to the modern surgical era was confined to either medical management of episodic symptoms, or sectioning of the trigeminal nerve.1-4
Doyen first described the use of endoscopes in skull base surgery in 1917, when he performed trigeminal neurectomy under endoscopic guidance.\textsuperscript{3} However, it was not until the 1990's that endoscopic sinus surgery spurred a renewed interest in the application of endoscopy to intracranial pathology.\textsuperscript{8}

In 1997 Eby JB, began performing endoscope-assisted vascular decompression for the trigeminal nerve, and have reported there results.\textsuperscript{9} While performing the endoscope assisted procedure they determined that nearly 25\% of neurovascular conflicts were missed during the regular MVD. In addition to the improved identification of conflicts, they also discovered that the endoscope allowed access to the trigeminal nerve with little or no cerebellar retraction and with minimal dissection. This led to there interest in converting to a fully endoscopic approach. In September of 1999 they converted to a fully endoscopic vascular decompression (EVD) surgical procedure and have published this technique.\textsuperscript{10}

In the current study we report the results for our limited series of patients that have undergone EVD of the trigeminal nerve, and compare these results to data from several large EVD series.
PATIENTS AND METHODS

Between September 2004 and October 2011 a total of 40 patients suffering from trigeminal neuralgia underwent EVD; all operations were done in my university and private hospitals and retrospectively reviewed and information from follow-up visits was collected to assess operative success rates, and the incidence of complications we used rigid endoscope with 4 mm diameter and 0, 30 degree angle working lenses.

Table 1: Postoperative relief was graded as documented by Barker tab.

<table>
<thead>
<tr>
<th>Type</th>
<th>% of pain relief</th>
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<tbody>
<tr>
<td>complete</td>
<td>98%</td>
</tr>
<tr>
<td>satisfactory</td>
<td>More than 75%</td>
</tr>
<tr>
<td>None</td>
<td>Less than 75%</td>
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The incidence of complications was collected and the category "temporary" referred to any deficit, which was completely resolved within three months postoperatively. Permanent deficits were further classified by severity. The incidence of facial numbness was graded as "mild" representing a diminution in fine touch sensation or two point discrimination. Patients with "severe" numbness demonstrated near complete or complete anesthesia in one or more branches of the trigeminal nerve. The category "moderate" encompassed all degrees of facial numbness, which fell between that of "mild" and "severe". Permanent hearing deficits were graded as: "profound" > 60 db hearing loss, whereas a 30-60 db deficit was graded as "mild". Permanent facial nerve palsies were graded using the House-Brackmann six point subjective grading
scale and were divided into "mild" (grades II-III), and "severe" (grades IV-VI).

Surgical Procedure

The procedure begins with the patient in a park bench position. A 2cm retrosigmoid craniotomy is performed, and the CSF is slowly drained. The 00 endoscope is then guided into the cerebellopontine angle, without retraction and with minimal dissection to visualize the acoustico-facial bundle and the trigeminal nerve. superior cerebellar veins may be sacrificed, arachniod adhesion around the neurovascular complex are freed, Neuro-vascular conflicts affecting the trigeminal nerve are identified and gently dissected free from the nerve.
Endoscopic view of trigeminal nerve (tn) with petrosal veins (pv)

Superior cerebellar artery (sca) compressing trigeminal nerve (tn)

Separation of arachnoid adhesions
Once decompression is complete a 30 endoscope is advanced into this region to once again survey the nerve and surrounding structures to assess the adequacy of decompression. Additional conflicts were occasionally encountered, and were likewise separated from the nerve. Teflon pledges are then placed between the nerve and offending vessel(s), in ten cases no teflon grafts were inserted. The dura, soft tissues and the craniotomy are then closed in anatomical layers without the use of any drains, patients are then taken to the surgical intensive care unit or a step-down unit for overnight observation.

**RESULTS**

A total of 40 patients underwent EVD for treatment of trigeminal neuralgia during the 84 month period of this study. Mean operative time was 75 minutes. Average length of hospital stay was two days, with 20 (50%) patients discharged within 24 hours postoperatively.

A female: male ratio of greater than 2:1, a mean age of 51 years The mean duration of symptoms was just over 6 years. All patients operated for first time except two patients, one had Gamma knife Radiosurgery and other had injection of Gasserian ganglia.

All patients underwent magnetic resonance imaging while magnetic resonance angiography of the cerebellopontine angle preoperatively in 5 patients. In this series MR imaging identified vascular compression <12% of cases. Left side was affected more than right side (Tab.2). Intraoperatively vascular compression was identified in 100% of patients. Moreover, 5% of patients had more than one structure compressing the trigeminal nerve. Table 2 lists the vascular structures found to be compressing the trigeminal nerve at the time of surgery.
Table 2: vascular structures found to be compressing the trigeminal nerve

<table>
<thead>
<tr>
<th>Side of neuralgia</th>
<th>Rt.,(12)</th>
<th>Lf.,(28)</th>
<th>Bilateral,(o)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of nerve affection</td>
<td>T1</td>
<td>T2,( 5)</td>
<td>T3,(20)</td>
</tr>
<tr>
<td>Type of vascular compression</td>
<td>Sca, (34)</td>
<td>Aica,(4)</td>
<td>Sca+aica,(2)</td>
</tr>
</tbody>
</table>

Outcome results are recorded in Table 3, 35/40 (95%) of patients experienced initial (within 3 postoperative months) "complete" pain relief, while 4/40 (10%) had an initial "satisfactory" relief; one patient had no relief. On three-year follow-up period (26 patients) included only those patients 20/26 (90%) had "complete" relief while 5/26 (10%) had "satisfactory" relief, 1 patients (2%) had no relief.

Table 3: Outcome of pain relief

<table>
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<tr>
<th>Complete pain relief</th>
<th>35</th>
<th>92.5%</th>
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<tbody>
<tr>
<td>Satisfactory pain relief</td>
<td>4</td>
<td>10%</td>
</tr>
<tr>
<td>No pain relief</td>
<td>1</td>
<td>2.5</td>
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The mean follow-up was 38 months (range6-70 months). Temporary facial nerve weakness was recorded in 3/40 (7%), none of the patients had persistent facial nerve deficit.
With regards to postoperative facial numbness, 2 patients had preoperative facial numbness from prior procedures. 3/40 (7%) reported temporary facial numbness; 3/40 (7%) patients reported persistent mild facial numbness; while 1/40 patients (2.5%) noted severe facial numbness.

The incidence of CSF leakage was 6/40 (15%), of note that 5/6 leaks occurred during the early portion of our surgical experience. CSF leaks were noted in 5 out of the first 27 patients, whereas there was only 1 CSF leak noted in the last 13 patients.

There were no serious complications such as epidural or subdural hematomas, air emboli, brainstem infarction or death.

**DISCUSSION**

Surgical approaches to the cerebellopontine angle have undergone a variety of modifications since early surgical pioneers first attempted sectioning of the trigeminal nerve in the early 1900's. Currently, the microvascular decompression operation represents the surgical procedure by which other techniques are compared.\(^{5-8}\)

Recently, a shift toward minimally invasive skull base surgical techniques has ultimately fostered the application of endoscopy to access the narrow confines of the cerebellopontine angle. It must be noted however, that reducing the size of the incision and attempting to minimize complications through a minimally invasive approach must not come at the expense of surgical outcomes, thus, this report was designed to address the efficacy of EVD.
Relief of Neuralgia

Previous studies have demonstrated that the 00 and 300 endoscopes provide a panoramic view of the trigeminal nerve from the pons to Meckel's cave; with illumination and exposure that is far superior to that of the operating microscope. The improved exposure of the endoscope has also been shown to result in improved rates of neurovascular conflict identification.

A recent review by Lovely and Janetta of over 2700 microvascular decompression operations, with an average of 4.4 years follow-up noted a 20-25% recurrence rate and an overall 6-38% failure rate. Several other reports have documented that between 10-86% of patients re-explored for persistent or recurrent trigeminal neuralgia after microvascular decompression are found to have areas of compression. These initial failures and recurrences are thought to result from incomplete identification of all neurovascular conflicts, or incomplete decompression at the time of the initial operation.

We believe that the improved visualization provided by the endoscope should in turn lead to better long-term surgical outcomes. Our EVD outcomes results in initial relief of neuralgia pain. Additionally, we documented a better outcome and a reduced recurrence at three-year postoperative follow-up, demonstrating complete relief in 92.5% of patients for EVD. while in large series of Kabil and his colleagues (255 patients) demonstrate 94% complete relief.

Complications

A smaller craniotomy, less dissection and the elimination of retraction should inherently lead to a further reduction in the number of complications. Our complication rates for this series compare favorably with those published for most EVD series.
Manipulation of the trigeminal nerve is thought to be responsible for the occurrence of facial numbness following MVD. The endoscopic procedure provides improved visualization of the nerve therefore requiring less dissection to recognize conflicts. However, the identification of additional conflicts requires that these insults be dissected free to ensure complete decompression. This manipulation of additional vessels found to be compressing the trigeminal nerve might account for the slightly higher incidence of facial numbness in the EVD series. The majority of the postoperative facial numbness was graded as mild, and no patients suffered from painful dysesthesias.

The endoscope enters the region of the cerebellopontine angle with minimal dissection and in most cases without the need for cerebellar retraction; it then provides excellent exposure of the trigeminal nerve. As a result, the incidence of complications such as retractor injury of the brainstem, cerebellum, and acoustico-facial bundle should diminish. No patient sustained a permanent facial nerve injury, and only 2 patients experienced mild, temporary facial nerve palsies. There were no instances of subdural, epidural, or cerebral/cerebellar infarction in this series, nor was there any mortality as a result of this procedure.

Our incidence of CSF leaks (15%) is higher than that reported for most EVD series. With experience, we have improved our closure technique. We often reinforce the dural closure with a fascial graft and close the subcutaneous tissues in multiple layers. These modifications have resulted in a significant reduction in the incidence of this complication, with only 1 CSF leak occurring in the last 15 patients for an incidence of 7%.
The minimally invasive approach results in less mastoid air cell disruption, which should decrease the incidence of meningitis and postoperative middle ear effusions. There were no instances of meningitis recorded in this series.

CONCLUSION

The advantages of the endoscope are numerous, and are expected to lead to improved outcomes and decreased morbidity. This series provides evidence as to the safety and convenience of this approach. In this series, EVD showed a significant advantage with regards to outcomes and complications.

Moreover, the results in this series of EVD at three-year follow-up show a trend toward a reduction in recurrence rates. We believe that further long-term series results will confirm that EVD offers significant advantages. The beneficial aspects of endoscopy are translated into better surgical outcomes. The fact that it is a more direct and a less invasive approach has lead to a shorter operative time (mean: 60 minutes) and length of stay (mean: 1.3 days), leading us to conclude that fully endoscopic vascular decompression represents a step-forward in safe and effective surgical treatment of trigeminal neuralgia.
REFERENCES


الملخص العربي

المنظار الجراحي في عمليات فصل العصب الخامس عن الشرايين الملاصقة له

مصطفى السيد

جراحة المخ والاعصاب، كلية الطب – جامعة الأزهر بالقاهرة

إن استخدام المراقبة الجراحية في عمليات فصل العصب الخامس عن الشرايين الملاصقة له يحمل مزايا عديدة فهو يحسن النتائج ويقلل المضاعفات. المراقبة الجراحية يدخل مباشرة إلى منطقة العصب الخامس دون شد أو جذب التركيب العصبي المحيطي يؤدي ذلك إلى تقليل وقت العملية وبالتالي قصر مدة البقاء المستشفى. ويوصى البحث باستخدام المراقبة الجراحية في فصل العصب الخامس لمزيد من تحسن النتائج واكتساب الخبرة وتبسيط التكاليف.