

## ORIGINAL ARTICLE

# Endoscopy Assisted Microvascular Decompression for Vascular Conflict Syndromes in 22 Patients

Yildirim A. Bayazit, Tolgahan Catli, Nebil Goksu

Department of Otorhinolaryngology, Faculty of Medicine, Gazi University, Ankara, Turkey

**Objective:** To present the results of our clinical experience with endoscope assisted vascular decompression performed for different vascular conflict disorders such as hemifacial spasm, trigeminal neuralgia, tinnitus, and trigeminal neuralgia plus disabling positional vertigo.

**Materials and Methods:** Twenty-two decompressions were performed between 1999 and 2008 (7 men and 15 women with ages ranging from 24 to 77 years). An endoscope assisted retrosigmoid approach was used in the surgeries.

**Results:** Eighteen of 22 patients had complete relief of the symptoms, and 3 had a partial and one had no relief in the symptoms. No perioperative complication was encountered. The major offending vessels were anterior inferior cerebellar artery (AICA) in 8 patients, vertebral artery (VA) in 6 patients, superior cerebellar artery (SCA) in 2 patients, posterior inferior cerebellar artery (PICA) in 4 patients, and both AICA and VA in 2 patients. Two patients have become normotensive after decompression of the left medulla oblongata as well.

**Conclusion:** Microvascular decompression provides a significant relief in the alleviation of the symptoms of the patients who had conflict syndromes. Endoscopes, especially 45 degree, act as an adjunct to microscope in the precision of the offending vessel in the root entry zone.

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## Introduction

The clinical significance of vascular compression to the cranial nerves was first proposed by Dandy <sup>[1]</sup>, and decompression surgery was first described by Gardner <sup>[2-4]</sup>. Jannetta described decompression using operating microscope and quoted the name microdecompression <sup>[5-6]</sup>.

The vascular conflict syndromes result from the compression of one or more of the cranial nerves by an offending vessel in the cerebellopontine angle, and the compression site is usually at the root entry zones of the nerves <sup>[7]</sup>. In the root entry zone, the cranial nerve lacks a myelin sheath as the nerve acquires a myelin cover in its periphery. The abnormal neuronal activity elicited by the vascular pulsation may either cause an ephaptic transmission in the cranial nerve (peripheral theory) or an activation in the nucleus of the nerve through an antidromic stimulation (central theory) <sup>[8-10]</sup>. Depending on the function of the cranial nerve, this abnormal neuronal activation results in one of the vascular conflict syndromes like hemifacial spasm, trigeminal neuralgia, tinnitus or disabling positional vertigo.

The purpose of this retrospective study was to present the results of our clinical experience in the treatment of various vascular conflict syndromes in which endoscope assisted microvascular decompression was performed via a retrosigmoid approach.

## Materials and Methods

Twenty-two patients who were operated on for various vascular conflict syndromes between 1999 and 2008 were included in this retrospective study. There were 7 men and 15 women with ages ranging from 24 to 77 years (mean 43 years). The diagnoses were trigeminal neuralgia, hemifacial spasm, tinnitus, and coexistence of trigeminal neuralgia and disabling positional vertigo. The diagnoses were made on the basis of history, neurotologic examination and magnetic resonance imaging, and audiovestibular testing (pure tone and speech and evoked response audiometry) when necessary. Auditory brain stem response testing has been helpful in cochlear nerve compression, especial in tinnitus patients, where an elongation of wave I-III interval was expected <sup>[11-14]</sup>.

All operations were performed via retrosigmoid approach, and microvascular decompression of the

### Corresponding address:

Yildirim A. Bayazit  
Dept. of Otolaryngology Faculty of Medicine, Gazi University Besevler, Ankara Turkey  
e-mail: bayazity@yahoo.com

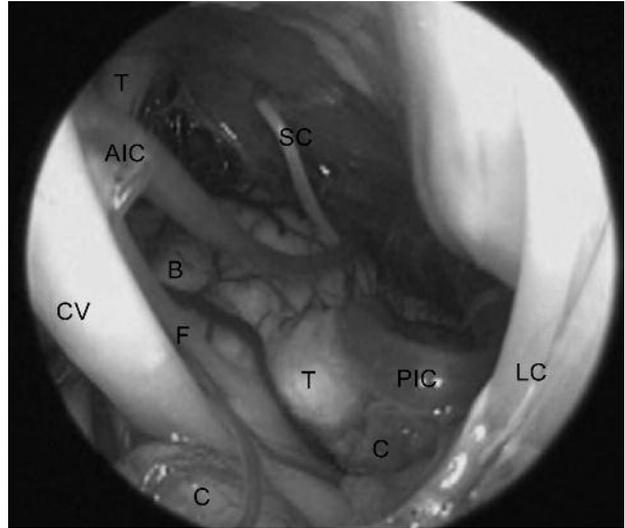
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offending vessel was performed. A standard 45 degree sinus endoscope was used to inspect the root entry zones of the cranial nerves after entering the cerebellopontine angle in order to identify precisely the offending vessel. The endoscope was used to inspect the medial aspects of root entry zones of the cranial nerves, which cannot be seen properly under microscope (Figure 1) Following endoscopic identification of the neurovascular relationship, decompression was performed with a piece of muscle or Teflon cushion using operating microscope and/or endoscope depending on the site of compression. Endoscopic decompression was made when the compression site was medial to the root entry zone. All surgeries were uneventful, and the patients were discharged after one week.

**Results**

All patients completed at least 6 month follow up. There were 12 hemifacial spasm, 4 trigeminal neuralgia, 4 tinnitus and 2 trigeminal neuralgia plus disabling positional vertigo cases. In hemifacial spasm, a complete relief was achieved in 11 of 12 (91.7%) patients while there was a partial relief in the remaining patient (8.3%). All patients with trigeminal neuralgia and the patients with trigeminal neuralgia plus disabling positional vertigo had complete relief of their symptoms. In cases of tinnitus, a complete and partial relief was achieved in 2 (50%) and 1 (25%), respectively. Worsening of the tinnitus severity was encountered in 1 (25%) patient.

The major compressing vascular structures were anterior inferior cerebellar artery (AICA) in 8 patients, vertebral artery (VA) in 6 patients, superior cerebellar



**Figure 1.** Endoscopic view of the cerebellopontine angle on the right side. Note that microvascular decompression of the facial nerve is performed in a patient with hemifacial spasm. T; Trigeminal nerve, AIC; anterior inferior cerebellar artery, SC; sixth cranial nerve, B; brainstem, CV; cochleovestibular nerve, FN; facial nerve, T; teflon, PIC; posterior inferior cerebellar artery, C; choroid plexus, C; cerebellum, LC; lower cranial nerves

artery (SCA) in 2 patients, posterior inferior cerebellar artery (PICA) in 4 patients, and both AICA and VA in 2 patients (Table 1).

One patient who had both trigeminal neuralgia and disabling positional vertigo, and 2 patients with hemifacial spasm also had essential hypertension preoperatively. In their magnetic resonance imaging, the offending vessels were VA (n=2) and PICA (n=1), and there was a compression on the left medulla

**Table 1.** Diagnoses, offending vessels and outcomes of the patients.

Diagnosis	Offending vessel	Outcome
<b>Hemifacial spasm (n=12)</b>	<b>PICA (n=4)</b>	Complete relief (n=11)
	<b>VA (n=4)</b>	Partial relief (n=1)
	<b>AICA (n=3)</b>	
	<b>AICA + VA (n=1)</b>	
<b>Trigeminal neuralgia (n=4)</b>	<b>SCA (n=2)</b>	Complete relief
	<b>AICA (n=1)</b>	
	<b>VA (n=1)</b>	
<b>Trigeminal neuralgia plus disabling positional vertigo (n=2)</b>	<b>VA (n=1)</b> <b>AICA + VA (n=1)</b>	Complete relief
<b>Tinnitus (n=4)</b>	<b>AICA (n=4)</b>	Complete relief (n=2)
		Partial relief (n=1)
		Worsening (n=1)

oblongata as well. In these patients, decompression was performed both in the root entry zones of the cranial nerves and in the left medulla oblongata. After the operation, these patients have been normotensive and stopped taking antihypertensive medications.

### **Discussion**

Vascular conflict syndromes involve a variety of disturbances attributable to the compression of the cranial nerves. Microvascular decompression for trigeminal neuralgia, hemifacial spasm, tinnitus, disabling positional vertigo and glossopharyngeal neuralgia has been performed rarely due to the considerations of inadequacy of the diagnostic methods, potential complications and invasiveness of the surgery, inability to visualize an offending vessel intraoperatively, or due to some magnetic resonance imaging data suggesting that vascular cross compression is a fiction rather than a fact.

Improvements in magnetic resonance imaging techniques allowed detecting neurovascular relationship as well as vascular conflict in the cerebellopontine region [15-17]. Magnetic resonance imaging is important in determining the surgery as there is usually a correlation between the imaging and surgical findings [18]. It was suggested that in decompression surgeries performed for the trigeminal neuralgia, magnetic resonance imaging predicted neurovascular conflict with sensitivity of 93.6% and specificity of 100% [19]. Intraoperatively, the root entry zone has to be inspected properly in order to identify the offending vessel. Endoscope assisted surgery can be helpful at this stage of the surgery [20]. As an adjunct to the operating microscope, a 45 degree endoscope facilitates proper inspection of the neurovascular relationship in the medial aspect of root entry zones.

The success rates of microvascular decompressions performed for hemifacial spasm and trigeminal neuralgia exceed 80% [21, 22]. The success rate of microvascular decompression for tinnitus varies from 40% to 77% in different series [23-25]. Our results seem comparable to the results reported in the literature as well. On the other hand, decision making in vascular decompression for tinnitus creates a dilemma both for the patient and surgeon. In our practice, the following criteria has been used to decide about microvascular decompression for tinnitus; i) tinnitus must be unilateral; ii) there must be no other cause to explain the occurrence of tinnitus; iii) an offending vessel must be visible on magnetic resonance imaging; iv) there

must be an elongation in wave I-III interval on auditory brainstem response testing; and v) the patient may also have a mild sensorineural hearing loss in the high frequencies.

The rostral ventrolateral reticular nucleus (RVL) of the medulla oblongata on the left side functions in the control of blood pressure. This central area is connected with the rostral end of the inferior olivary nucleus which is also connected with the solitary tract nucleus (STN). STN is also the termination site for baro and chemoreceptors which collects the information of vascular pressure and partial carbon dioxide saturation from the aorta and carotid sinus via the glossopharyngeal and vagus nerves. RVL medulla gives projections to the spinal cord and principal tegmental tract. This tract is the source of tonic and reflex drive to preganglionic neurons of the spinal cord. Electrical stimulation of RVL elicits an elevation in arterial pressure. In humans this phenomenon was first reported by Jannetta and Gendell in 1979 [26]. We observed similar results in 3 patients who became normotensive after decompression of the medulla oblongata on the left side as well.

Retrosigmoid approach to the cerebellopontine region possesses some potential complications such as cerebrospinal fluid leakage, facial weakness, neurological deficits and hearing loss. However, no complication was encountered in our series.

In conclusion, the surgical treatment of vascular conflict syndromes such as hemifacial spasm, trigeminal neuralgia, tinnitus, and trigeminal neuralgia plus disabling positional vertigo with microvascular decompression provides a significant relief in the alleviation of the symptoms of the patients. Since the offending vessel usually compresses the cranial nerve in the root entry zone which is close to the brainstem, a 45 degree endoscope helps identify the offending vessel properly, thereby prevent possible misinterpretations under the visual field of the operation microscope. In our experience, endoscopy assisted approach to posterior fossa is an effective and safe procedure in vascular conflict syndromes.

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