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Microvascular Decompression of the Vestibulocochlear Nerve

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Abstract:

Background: Microvascular decompression of cranial nerves began in the 1960's as a novel approach to treating patients for trigeminal neuralgia. Decompression of other cranial nerves for a variety of other symptoms has followed. *Design:* We present a case of microvascular decompression for intractable tinnitus and hearing loss. Pre and post-operative Pure Tone Audiometry (PTA) and Tinnitus Handicap Index (THI) were measured as primary outcomes and the patient was followed for one year. *Results:* Tinnitus severity reduced transiently after decompression, and hearing was preserved. *Conclusion:* Microvascular decompression of the vestibulocochlear nerve can treat tinnitus, vertigo, and hearing loss in severe cases where other treatments have failed. Patient selection is poorly understood and patient's expectations must be carefully managed.

Key words: Hearing loss, Microvascular Decompression Surgery, Tinnitus, Vertigo, Vestibulocochlear Nerve.

Introduction

Vascular compression of the cranial nerves can be significantly debilitating, and can occasionally warrant invasive surgery. Compression of the trigeminal root by vascular loops was initially noted by Dandy in approximately one third of patients with trigeminal neuralgia [1]. Jannetta [2] further explored this and found that the trigeminal nerve can be physically distorted by the compression of very small vessels usually arising from the anterior inferior cerebellar artery. These discoveries lead to embarking on surgical treatment to mobilize impinging vessels away from the nerve. More recently, the application of these techniques has expanded to include multiple other cranial nerves that become diseased by vascular compression. Since its advent, microvascular decompression has be-come part of the neurosurgeons common armamentarium with published series of up to 4000 cases [3].

Long term success rates of microvascular decompression for trigeminal neuralgia, hemifacial spasm, and vertigo are 70% [4], 84% [5], and 80% [6] respectively. Though the experience is globally less, success (defined as any improvement) of microvascular decompression of the 8th nerve for tinnitus varies from 50% to 80% [7,8]. In a meta-analysis of microvascular decompression of the vestibulocochlear nerve [9], only a single case underwent surgery for isolated hearing loss [10]. The remaining 544 cases across 19 series underwent MVD for vertigo or tinnitus. Hearing change

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after MVD was noted to be a common secondary outcome and in 227 patients who had hearing loss prior to surgery, 49 (21%) had improvement in hearing thresholds and 16 (7%) had deterioration in hearing.

Case Report

Our case is a middle aged woman who was referred to the Department of Neurosurgery for intractable tinnitus of over 5 years duration. The Tinnitus Handicap Index (THI) is a widely used subjective assessment of tinnitus severity which can identify which life domains are affected by tinnitus. A moderate score (48%) was rated pre-operatively. Enjoyment of life, occupational function, sleep, and emotion wellbeing were rated as being most affected. Concomitantly a bilateral sensorineural hearing loss was noted, worse on the left.

On clinical examination the patient had facial symmetry with normal facial nerve function. She denied facial spasm, facial pain, or headache. Weber test with 512 Hz tuning fork lateralized to the right ear. Micro-otoscopy was normal. The remainder of the gross neurologic examination was unremarkable. Pure Tone Audiogram pre-operatively [Fig.1] shows air conduction thresholds for both ears. There was no conductive element to the hearing loss. An MRI had been performed prior to referral to investigate the cause for the asymmetry in hearing thresholds. This demonstrated a vascular loop abutting the left facial and auditory nerve complex. The patient was counseled on the risks of surgery, including lack of improvement in her symptoms.

The patient was placed in Mayfield pins with the head extended 15 degrees and rotated to the right. A retroauricular curvilinear incision was made and a left retrosigmoid craniotomy was formed. Dura was opened and the cisterna magna was tapped. Dissection into the cerebellopontine angle was achieved with gentle retraction of the cerebellum. An ectatic loop of the anterior inferior cerebellar artery was seen to be impinging on

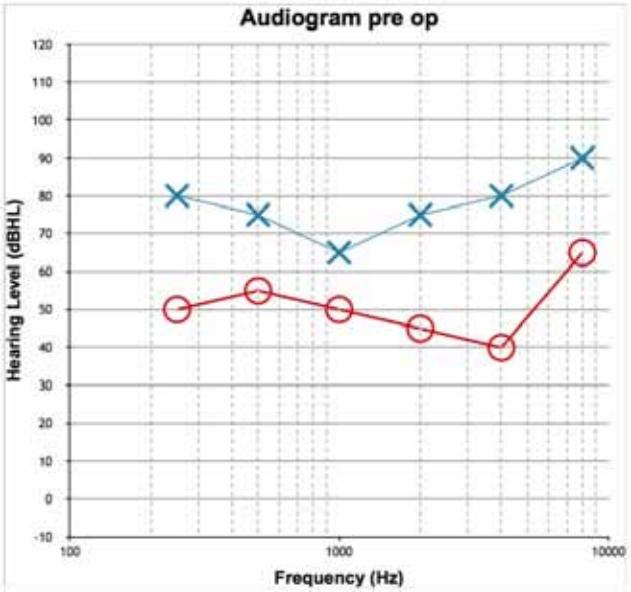

Fig.1: Pure Tone Audiometry pre-op. X = Left ear. O = Right ear.

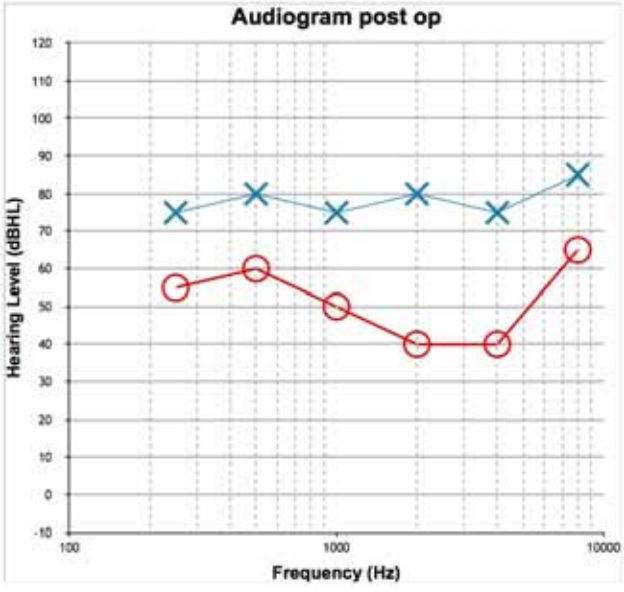

Fig.2: Pure Tone Audiometry post-op. X = Left ear. O = Right ear.

the facial and auditory nerve complex. After the arachnoid adhesions were gently lysed and the impinging vessel moved away from the nerve, teflon was placed between the vessel and the nerve complex. There were no immediate complications from the surgery.

After being discharged on day 3 post operatively, the patient was followed up at 6 months, and again at 1 year. Pure Tone Audiometry was repeated at 1 year post operatively. The THI (Tinni-tus Handicap Index) was used to establish the improvement in tinnitus symptoms. There were no immediate or delayed complications from the surgery. The facial nerve function was preserved. Pre and post op Audiograms are shown in Fig.1 and 2. These demonstrate no change in the hearing thresholds across all frequencies.

The Tinnitus Handicap Index (THI) improved from 48 (moderate) to 36 (mild) after surgery. The majority of questions were answered "sometimes" after surgery as opposed to "yes" prior to surgery. Most improvement was noted when asked: "Because of your tinnitus, do you have trouble falling to sleep at night?" which improved from "Yes to "No". The only factor that worsened after surgery was feeling tired which was rated "sometimes" to "yes".

Discussion

Case selection

There remains to be a clear set of diagnostic criteria or patient selection criteria for microvascular decompression of the vestibulocochlear nerve. Interestingly only half of the studies in the meta-analysis [9] used radiologically confirmed vascular compression as selection criteria for decompres-sion of the nerve. As an alternate, Brainstem auditory evoked potentials (BAEP) can identify con-duction abnormalities along the nerve but is not specific of vascular compression [11].

MVD for tinnitus

In cases of disabling tinnitus, MVD success appeared to be dependent on the duration of symptoms. Moller *et al*. [6] demonstrated in a cohort of 72 patients that total relief or marked improvement in tinnitus was observed in a subgroup of patients who had endured severe tinnitus for an average of 2.8 years. In contrast, those with only slight, or no improvement from surgery had been suffering for a longer time, average 5-9 years. De Ridder *et al*. [12] sought to identify the cut off duration of tinnitus to achieve success with MVD and hence aid in patient selection. Significant improvement in tinnitus was seen if decompression was performed within 4 years of onset of symptoms. After this 4 year period, no improvement was seen which is thought to be due to demye-lination as a result of long term compression.

The explanation for lower success rates for improving tinnitus is not fully understood [9]. Tinnitus is now understood to be a very complex disorder akin to phantom limb pain. Functional MRI studies have proven hyperactivity in the cochlear nuclei and the inferior colliculus of the brainstem in tinnitus sufferers [13]. Tinnitus has also been shown to persist in some cases following section of the vestibulocochlear nerve, which may explain persistence in some cases following MVD [14].

MVD for vertigo

Vertigo is more amenable to cure by microvascular decompression. 207 consecutive patients treated for disabling vertigo by way of MVD were cured in 80% of cases, and outcome was irrespective of duration of symptoms [6].

MVD for hearing loss

Hearing loss is a documented complication of MVD and can occur ipsilateral or contralateral to the

operated side in 50% and 25% of cases for 7th nerve decompression, respectively [15]. Instrumentation of the auditory nerve, drill noise induced hearing loss [15] and over infusion of saline into the subdural space during surgery [16] have been postulated as potential mechanisms for this. Auditory brainstem responses can be measured intra-operatively to alert the surgeon of intraoperative trauma to the auditory nerve though this is a poor predictor of post-operative hearing impairment [15]. Hearing deterioration rates following surgery is 6.2% [9].

Conclusion

Microvascular decompression of the vestibulocochlear nerve can be successfully performed for disabling vertigo and tinnitus with varying success rates. In the current case, tinnitus was improved based on subjective questionnaire and hearing was preserved. This benefit was noted to be transient however, and the patient was re-referred for worsening tinnitus approximately 18 months post operatively, despite stable hearing thresholds.

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