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Posterior fossa vestibular neurotomy as primary surgical treatment of Menière's disease: a re-evaluation

R. Pareschi, D. Destito, A. Falco Raucci, S. Righini, S. Colombo*

Abstract

Fifty-eight patients underwent vestibular neurotomy via the posterior fossa approach between September 1992 and December 1998 at the ENT department of Legnano. All patients presented a history of disabling unilateral Menière's disease and underwent complete neuro-otologic evaluation following the 1985 American Academy of Otolaryngology – Head and Neck Surgery (AAO-HNS) guidelines. All patients underwent MRI imaging, ABR and electronystagmographic testing before surgery. Objective analysis of results is reported using the criteria published by the Committee on Hearing and Equilibrium of the AAO-HNS in 1985. According to the AAO formula, 52 patients obtained a score of 0, indicating complete control of major vertigo spells, while four were classified within the 'substantial control' group. Immediate hearing results indicated that 93 per cent of the patients maintained a level within 10 dB from the pre-operative level. Only one patient experienced a subtotal hearing loss yet retained measurable hearing. No major complications were reported. We conclude that a retrosigmoid approach to vestibular neurotomy can be considered a safe and effective procedure in relieving medically refractory vertigo in Menière's disease while preserving the hearing. Tinnitus and long-term hearing deterioration are not influenced by the procedure.

Key words: Menière's Disease; Surgical Procedures, Operative; Treatment Outcome

Introduction

The role of selective vestibular neurotomy (VN) has become widely accepted in the treatment of medically refractory vertigo in Menière's disease and other ear-related vertigo.[1–4]

The main advantage of VN is that, for the majority of patients, hearing is preserved while vertigo is controlled.[5] However, over the years, the best approach for sectioning the vestibular nerve continues to be a matter of debate and controversy.[6]

Vestibular nerve section with complete division of the eighth cranial nerve was performed by the suboccipital route in the early 1990s. The middle cranial fossa (MF) approach was described by House in 1961[7] and became the predominant route used in the 1960s and 1970s as it allowed transection of both superior and inferior vestibular nerves, leading to excellent control of vertigo. This approach, however, presents a significant incidence of facial weakness and deafness. In 1978, Silverstein and Norrel introduced the retrolabyrinthine approach as an alternative to the middle fossa vestibular neurotomy (MFVN). This approach was technically easier than the MF approach and was associated with lower morbidity.[8] In 1986, Silverstein[9] presented the retrosigmoid-internal acoustic canal (IAC) VN as a better method for a more complete transection of the vestibular fibres and, more recently, in 1989, the combined retrolabyrinthine-retrosigmoid approach was introduced. Since 1992, the posterior fossa approach has become the route of choice for VN in our institution.[2]

The aim of this study was to support the adequacy of retrosigmoid VN by reviewing our results regarding vertigo control, hearing preservation and complications of this procedure.

Methods

We retrospectively studied 58 patients suffering from Menière's disease from September 1992 to December 1998 at the Department of Otolaryngology of Legnano. The patients ranged in age from 32 to 74 years; 26 (45 per cent) were men and 32 (55 per cent) women.

All patients presented a medical history of drug-resistent vertigo. Diet control and diuretics (hydrochlorothiazide) were typically recommended. Vasodilators were used in individuals refractory to

From the Unità operativa di Otorinolaringoiatria, Azienda Ospedale Legnano and *Clinica Otorinolaringoiatrica, Università degli Studi di Padova, Padova, Italy.
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diuretic therapy. Three patients had undergone unsuccessful chemical labyrintectomy, none had had previous surgery.

All patients were asked to give a subjective evaluation of the effective control of vertigo, hearing status, presence of tinnitus, aural fullness sensation and unsteadiness.

Objective analysis of the results is reported using the criteria published by the Committee on Hearing and Equilibrium of the American Academy of Otolaryngology – Head and Neck Surgery (AAO-HNS) in 1985.[10]

Pre-operative evaluation

Each patient's history, neuro-otologic examination and previous metabolic and radiographic evaluation were closely reviewed to ensure that all patients received an appropriate diagnosis and to affirm that all medical treatments had been unsuccessful.

Hearing levels were assessed with a four-frequency pure tone average (PTA) and speech discrimination score (SDS). PTA was evaluated at 500 Hz, 1 KHz, 2 KHz and 3 KHz as suggested in the AAO-HNS guidelines. Pre-operative hearing levels were determined by taking the worst PTA. Pre-operative ABR testing exhibited normal results in all patients.

Electronystagmographic testing showed a reduced response in 32 patients (55 per cent). MRI with gadolinium injection was obtained for each patient in order to exclude other causes that could account for their vertigo.

Surgical technique

The patient is placed in a supine position with head turned, as in all standard lateral otologic approaches. Intra-operative eighth and/or seventh cranial nerve monitoring is not considered essential, as proved by post-operative results.

A retroauricular curvilinear incision is performed approximately six to eight cm behind the postauricular sulcus. The skin flap is elevated and fixed anteriorly. A U-shaped, inferiorly based, musculoperiosteal flap is outlined and elevated; the muscular attachments to the occipital bone and the mastoid tip are severed with cutting diathermy. An approximate 5 × 5 cm retrosigmoid craniotomy is then performed. The posterior half of the sigmoid sinus and the inferior half of the transverse sinus are used as anatomical landmarks. Any open mastoid air cell is thoroughly obliterated with bone wax. A reverse T incision of the dura is performed and the two dural flaps are retracted using stay sutures. Cerebellar retraction is carried down to the cerebro-pontine angle (CPA) and cerebrospinal fluid (CSF) is allowed to drain from the cisterns. The shrinkage of the cerebellum allows an easy identification of the seventh and eighth nerve from the brain stem to the porus acusticus and of the other cranial nerves.

In the majority of cases a cleavage plane between the cochlear and vestibular nerve can be identified. The superior half of the nerve bundle is first separated and then transected with small microscissors. Once the neurotomy is completed and haemostasis has been obtained, the dura is closed with 5-0 sutures and reinforced with temporal muscle fascia and fibrin glue. The bone flap is repositioned and the muscle-periostial tissue and skin are sutured. No drain is used.

TABLE I
VERTIGO RESULTS (AAO-HNS 1985 CLASSIFICATION)

Vertigo control	Number of Patients	Per cent
Complete control	52	89.7
Substantial control	4	6.9
Limited control	1	1.7
Insignificant control	1	1.7
Worse control	0	0
Total	58	100

Results

Vertigo

Fifty-two patients have been completely relieved of major spells of vertigo, while six patients developed major spells after the operation (from six to 18 months after surgery). Using the AAOO formula, 52 patients (89.7 per cent) obtained a score of 0, indicating complete control of vertigo spells (Table I).

The scores of the six patients whose vertigo recurred meant that four of the patients (6.9 per cent) were classified in the substantial control category, and one (1.7 per cent) each in the limited and insignificant control categories (Table I). Immediate post-operative vestibular symptoms due to sudden deafferentation were present in all patients but, in an average period of two months, 56 patients returned to normal life. Active vestibular rehabilitation has never been suggested.

TABLE II
HEARING RESULTS (AAO-HNS 1985 CLASSIFICATION)

	Immediate follow-up		Long-term follow-up	
	PTA	SDS	PTA	SDS
Unchanged (PTA ± 10 dB and or SDS ± 15 per cent)	47 (81 per cent)	42 (72.4 per cent)	22 (68.8 per cent)	21 (65.7 per cent)
Improved (PTA > 10 dB and or SDS > 15 per cent)	7 (12 per cent)	5 (8.7 per cent)	2 (6.2 per cent)	1 (3.1 per cent)
Worsened (PTA > 10 dB and or SDS < 15 per cent)	4 (6.8 per cent)	11 (18.9 per cent)	8 (25 per cent)	10 (31.2 per cent)
Total	58 (100 per cent)	58 (100 per cent)	32 (100 per cent)	32 (100 per cent)

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None of the patients whose vertigo recurred suffered from controlateral Menière's disease.

Hearing results

Following the AAO-HNS guidelines, patients were classified according to whether there was no change, improvement or worsening in their PTA and/or SDS levels (Table II). The PTA remained within 10 dB of the pre-operative level in 47 (81 per cent) patients, was worse by more than 10 dB in four (6.9 per cent) patients and was better by more than 10 dB in seven of 58 patients (12.2 per cent). The SDS was within 15 per cent of the pre-operative level in 42 (72.4 per cent) patients, was worse by more than 15 per cent in 11 (18.9 per cent) patients and was better in five (8.7 per cent) patients. Only one patient experienced an immediate post-operative profound hearing loss while retaining some measurable hearing.

Long-term follow-up (at least four years) revealed a progressive deterioration of hearing in 32 patients (Table II).

Other subjective symptoms

Six (10.2 per cent) patients reported less post-operative tinnitus, while 52 (89.7 per cent) reported no changes. Twelve (20.6 per cent) patients reported improvement in fullness and pressure sensation in the operated ear.

Fifty-two patients (89.7 per cent) experienced unsteadiness before surgery. Long term re-evaluation of this group showed complete resolution or subjective improvement of their unsteadiness in 30 (58 per cent) patients, while none of the remaining described it as worse. Of the six patients who did not experience pre-operative unsteadiness, three reported this symptom as permanent after surgery. While before surgery all patients considered themselves disabled and 24 (41.3 per cent) described their disability as severe (symptoms so severe as to exclude them from employment), after surgery 48 (82.7 per cent) patients no longer considered themselves disabled and only two claimed to be still severely disabled.

Complications

There were no major complications in any of the 58 patients.

Discussion

Vestibular neurotomy is an extremely effective procedure for vertigo control in patients with medically intractable Menière's disease. Owing to the inefficacy of shunting techniques we choose vestibular neurotomy as the initial surgical response.

Originally performed through the suboccipital approach, the procedure has moved to the middle fossa route introduced by W. House in 1961.[7] The retrolabyrinthine approach described by Silverstein in 1978[8] almost replaced the middle fossa and, more recently, interest has shifted again to the posterior fossa approach that has gained widespread acceptance in the last 10 years. Today, the majority of vestibular nerve sections are performed through the posterior fossa. The efficacy of this procedure in vertigo control is widely documented in the literature.[2]

Complete section of the vestibular nerve in the cerebellopontine angle has been a matter of debate as some authors observed that it is microscopically impossible to split the nerve because of the blending between vestibular and cochlear fibres along their interface.[11] Nevertheless, in this and other studies, this lack of ability to microscopically divide the nerve was of no account.[12] In our series, 56 (96.6 per cent) of the 58 patients experienced complete or substantial control of vertigo.

The two symptomatic patients had electronystagmographic evidence for persistence of vestibular function, indicating incomplete neurotomy. One of them had eight nerve sections through a translabyrinthine approach and he is now free from vertigo. We believe that if hearing has to be preserved a few patients will have an incomplete neurotomy due to the absence of a cleavage plane between the cochlear and the vestibular fibres or to the presence of vestibular fibres within the cochlear nerve.

The secondary goal of vestibular neurotomy is to preserve hearing in Menière's disease.[5,13] Studies on hearing in these patients are difficult because of the fluctuating and progressive nature of the hearing loss associated with the disease. The majority of studies show a stable hearing in 50–70 per cent of patients regardless of surgical technique, suggesting that none of the procedures employed can actually alter the natural course of the hearing loss.[1–5,13,15–18] Other studies on patients who have not been operated on have shown that hearing was stable as well and found no statistical difference between patients who underwent surgery and those who did not.

In the present study, hearing was preserved or improved in 54 (93.2 per cent) patients undergoing posterior fossa vestibular neurotomy. Hearing results were stable in the short-term (up to 24 months), but a longer follow-up indicated that this stabilization was not continued over time. Thirty-two patients from our series, observed for at least four years, showed a trend towards a progressive deterioration of hearing. Our study shows a 12.2 per cent improvement after surgery although the mechanism responsible for hearing improvement remains obscure.

The risks associated with posterior fossa vestibular neurotomy remain limited. Only one patient (1.7 per cent) experienced a subtotal hearing loss, while retaining measurable hearing in the operated ear. This compares favourably to the four to eight per cent incidence of post-operative total deafness associated with other neurotomy procedures. Middle cranial fossa vestibular nerve section carries an eight to 10 per cent risk of a dead ear even in highly skilled hands, and transient facial paralysis is not uncommon (10–20 per cent). Possible aetiologies for hearing loss include: (1) unrecognized distribution of the labyrinthine artery and (2) disruption of the cochlear nerve fibres during neurotomy.

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Retrolabyrinthine vestibular nerve section presents a relatively high rate of CSF leaks (10 per cent). In our series a subcutaneous CSF collection occurred in four (seven per cent) patients. Direct sterile fluid aspiration, reapplication of the pressure dressing and treatment with a carbonic anydrasi inhibitor resolved the leak in all cases within a few days.

Major complications such as meningitis, wound infections and intracranial bleeding were absent in our series. No case of facial paralysis was reported.

Two patients reported persistent severe episodic vertigo after the operation. In these cases, post-operative electronystagmography with caloric testing documented some persistent vestibular function and translabyrinthine eight nerve section was suggested. One patient underwent the procedure with complete resolution of vertigo.

Conclusions

Fifty-eight patients with disabling Menière's disease underwent posterior fossa vestibular neurotomy between September 1992 and January 1998 at the ENT department of Legnano.

All patients were observed for two to six years after surgery. Vestibular and hearing results have been reported according to the 1985 AAO guidelines.[10] Complete vertigo control was obtained in 52 (89.7 per cent) patients and substantial control in four (6.9 per cent). Immediate post-operative audiograms revealed that hearing was maintained at its pre-operative level or improved in 54 (93.2 per cent) patients. Only one (1.7 per cent) patient experienced a profound hearing loss while retaining measurable hearing in the operated ear. No major complications were reported. Subsequent long-term follow-up revealed a progressive deterioration of hearing in 25 per cent of patients.

Our data show that vestibular nerve section can resolve only the vestibular symptoms: deteriorating hearing, fullness sensation and tinnitus usually persist. The progressive deterioration of hearing exhibited by most cases in our series probably represents the natural progression of the disease and cannot be influenced by this or other surgical procedures.

Analysing our experience, we conclude that posterior fossa vestibular nerve section can be considered a relatively safe and extremely effective procedure in relieving patients from major spells of vertigo in Menière's disease.

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Address for correspondence:
Roberto Pareschi, M.D.,
Direttore U. O. Otorinolaringoiatria,
Azienda Ospedale Legnano,
Via Candiani 2, 20025,
Legnano (MI), Italy.

Fax: +39 0331 449297
E-mail: rpareschi@inwind.it

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