The Journal of Laryngology & Otology (2009), ***123***, *379–382*.

doi:10.1017/S0022215108003150

Main Article

Hearing results following intratympanic gentamicin perfusion for Ménière's disease

E Kyrodimos, I Aidonis, A Sismanis

Abstract

Objective: To evaluate hearing results following intratympanic gentamicin perfusion in patients with Ménière's disease.

Materials and methods: Middle-ear perfusion of 0.4 ml of gentamicin 40 mg/ml solution was performed in Ménière's disease patients who had previously failed to respond to other medical treatment.

Results: Between May 1999 and November 2005, 22 patients (mean age 58.5 years) underwent intratympanic gentamicin perfusion. Mean follow up was 30 months. At the first post-perfusion visit (four to six weeks following perfusion), three of the 22 patients (13.63 per cent) had a pure tone average improvement of at least 10 dB, 15 (68.18 per cent) showed no change and four (18.18 per cent) demonstrated a decrease in hearing of more than 10 dB. Regarding speech discrimination scores, one patient (4.54 per cent) exhibited an improvement of at least 15 per cent, 15 (68.18 per cent) showed no change and six (27.27 per cent) showed a decrease of at least 15 per cent. After long-term follow up (12–40 months following perfusion), 10 patients (45.45 per cent) showed stable hearing, and 12 (54.54 per cent) exhibited a pure tone average decrease of more than 10 dB. Six patients (27.27 per cent) showed a speech discrimination score decrease of at least 15 per cent, while 16 (72.72 per cent) had no change. Complete cessation of vertigo was reported by 20 of the 22 patients (90.9 per cent), while two (9.09 per cent) reported episodic vertigo spells.

Conclusion: Intratympanic gentamicin perfusion provides effective control of vertigo in patients with Ménière's disease. However, significant hearing loss may occur immediately after perfusion; therefore, this treatment should be considered only for patients whose hearing has already been affected by the disease.

Key words: Meniere's Disease; Gentamicin; Middle Ear; Sensorineural Deafness

Introduction

Ménière's disease often presents a management challenge to the otolaryngologist. Diuretics, a low salt diet, vestibular suppressant medications and various surgical procedures are considered by many as very effective; however, the introduction of intratympanic perfusion of steroids and gentamicin as an office procedure revolutionised management of this malady.[1–3]

The aim of this retrospective study was to determine the incidence of hearing loss following gentamicin perfusion for Ménière's disease.

Materials and methods

Between 1 May 1999 and 30 November 2005, 22 Ménière's disease patients with unilateral Ménière's disease (13 women and nine men) underwent intratympanic gentamicin perfusion at the Virginia Commonwealth University Medical Center. All patients had previously failed to respond to medical treatment with diuretics, low salt diet, and intratympanic or oral steroids. The mean age of these patients was 58 years (range 18–85 years). All patients met the diagnostic criteria of definite Ménière's disease as established by the American Academy of Otolaryngology–Head and Neck Surgery.[4] These criteria defined hearing improvement as a change in the pure tone average (PTA), at 250, 500, 1000 and 2000 Hz, of more than 10 dB. An improvement in the speech discrimination score was defined as a change of more than 15 per cent. Decreases of 10 dB or more in PTA and of 15 per cent or more in speech discrimination score were considered to represent deterioration in hearing.

From the Department of Otolaryngology-Head and Neck Surgery, Virginia Commonwealth University Medical Center, Richmond, Virginia, USA.
Presented at European Federation of Otolaryngology Societies (EUFOS), June 30–July 4 2007, Vienna, Austria.
Accepted for publication: 12 May 2008. First published online 28 October 2008.

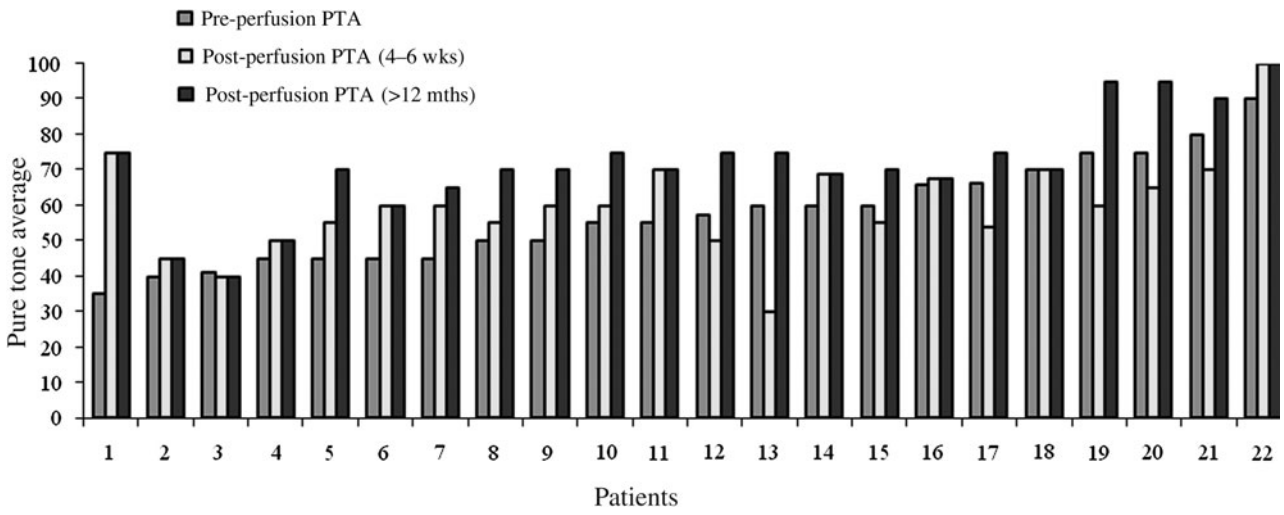

FIG. 1

Pre- and post-perfusion short-term (four to six weeks) and long-term (12 months or more) pure tone average (PTA) results. Wks = weeks; mths = months

Treatment was performed in the office with the use of a tuberculin syringe attached to a 31-mm, 27-gauge needle. Between 0.4 and 0.5 ml of gentamicin 40 mg/ml solution was delivered transtympanically under the surgical microscope. The needle was placed into the posterior-inferior aspect of the tympanic membrane, close to the round window niche. No local anaesthesia was used, and patients remained in the supine position with the head turned to the opposite side for a period of at least 20 minutes. Patients were asked to avoid swallowing or yawning in order to prevent drainage of the medication through the eustachian tube. At least two perfusions were performed at weekly intervals. Treatment was stopped immediately if ataxia and/or hearing loss developed. The mean number of perfusions was two (range two to six). Follow-up evaluation and audiological testing was performed at four to six weeks after completion of treatment, at 12 months and then biannually thereafter. Patients' mean follow up was 30 months (range 12–48 months).

Successful control of vertigo was defined as complete cessation of vertigo spells (American Academy of Otolaryngology–Head and Neck Surgery class A). A significant change in hearing was defined as a 10 dB improvement in PTA at 500, 1000, 2000 and 4000 Hz, and/or a speech discrimination score improvement of at least 15 per cent.

In this study, hearing loss was classified as stage I (<25 dB), stage II (26–40 dB), stage III (41–70 dB) or stage IV (>70 dB), according to the American Academy of Otolaryngology–Head and Neck Surgery criteria.

Results

Short-term results

Audiological evaluation performed during the first post-perfusion visit (four to six weeks after perfusion) revealed that three of the 22 patients (13.63 per cent) had a PTA improvement of at least 10 dB, 15 (68.18 per cent) showed no change and four (18.18 per cent) demonstrated a PTA decrease of more than 10 dB (Figure 1). Regarding speech discrimination scores, one patient (4.54 per cent) exhibited an increase of at least 15 per cent, 15 (68.18 per cent) remained unchanged and six (27.27 per cent) showed a decrease of at least 15 per cent (Figure 2). With respect to changes in the degree of hearing loss, one patient (4.54 per cent) progressed from stage II to stage III and one (4.54 per cent) from stage II to IV. Hearing improved in two patients (9.09 per cent) from stage III to stage II, and in three (13.63 per cent) from stage IV to III. All patients reported complete cessation of vertigo.

Long-term results

Between 12 and 40 months after gentamicin perfusion, 10 patients (45.45 per cent) showed stable hearing, and 12 (54.54 per cent) exhibited a PTA decrease of more than 10 dB (Figure 1). Regarding speech discrimination scores, six patients (27.27 per cent) showed a decrease of at least 15 per cent, while 16 (72.72 per cent) had no change (Figure 2). Hearing deterioration was noted in seven patients: one patient (4.54 per cent) progressed from stage II to IV, while six (27.27 per cent) progressed from stage III to IV. Complete cessation of vertigo was reported by 20 of the 22 patients (90.9 per cent); the remaining two patients (9.09 per cent) demonstrated episodic vertigo spells. Both of them received additional intratympanic perfusions – four perfusions for the first patient and six for the second.

No middle-ear or tympanic membrane complications were noted.

Discussion

Management of Ménière's disease often presents a challenge to the otolaryngologist, and many treatments have been proposed. Vertigo is often the most debilitating symptom associated with this

https://doi.org/10.1017/S0022215108003150 Published online by Cambridge University Press

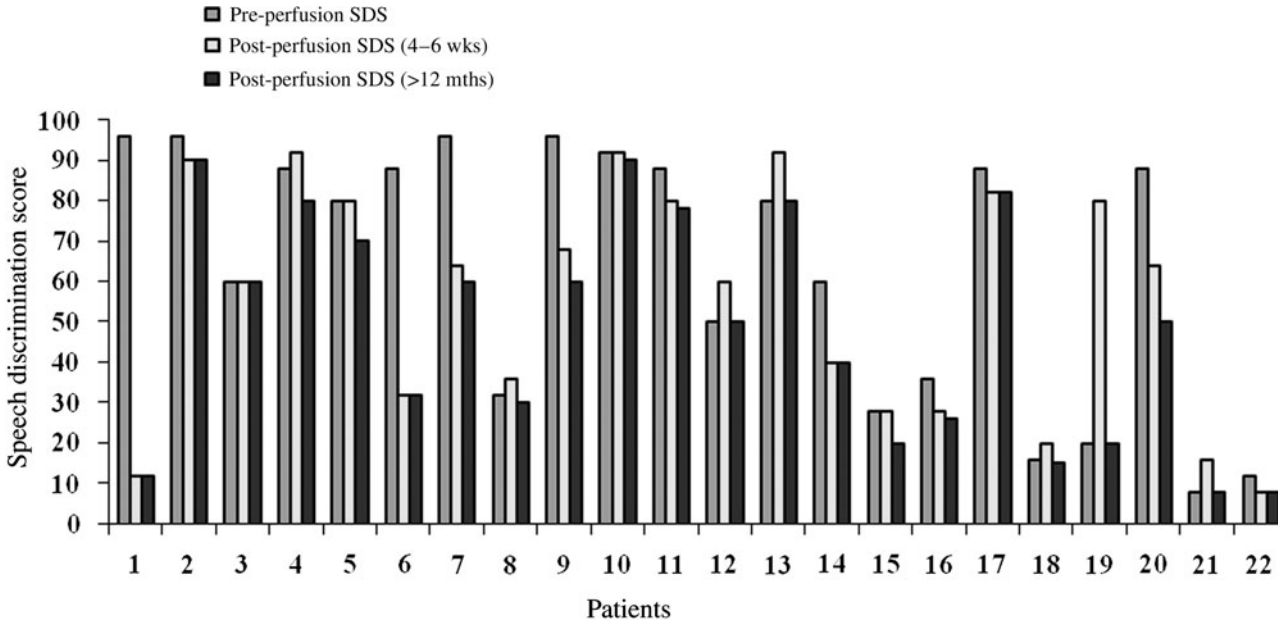

FIG. 2

Pre- and post-perfusion short- and long-term speech discrimination score (SDS) results. Wks = weeks; mths = months

entity; however, associated hearing loss is the most common long-term disability in Ménière's disease patients. Since intratympanic steroid and gentamicin perfusion was introduced for Ménière's disease at our institution, we have found that surgery is seldom necessary. At our institution, all newly diagnosed Ménière's disease patients are placed on a low salt diet (of less than 2000 mg per day) and are prescribed a potassium-sparing diuretic (a combination of hydrochlothiazide and triamterene). Written instructions for a low salt diet are provided to our patients and a return appointment is made for six weeks later. For patients who fail medical management and have serviceable hearing, intratympanic perfusion with dexamethasone 24 mg/ml is recommended, which is repeated in one week. For patients with non-serviceable hearing, or those who have failed intratympanic steroid perfusion, gentamicin perfusion is recommended.

In this study, complete vertigo control was achieved in all patients (100 per cent) in the short-term (four to six weeks) and in 92 per cent of patients in the long-term (12 months). All of our patients experienced some unsteadiness immediately after treatment, which subsided within four to six weeks.

Five patients (22.7 per cent) experienced various degrees of hearing loss immediately after treatment, including one patient with pre-existing mild hearing loss who developed severe hearing loss (4.54 per cent). It is of interest that five patients (22.7 per cent) experienced significant hearing improvement and nine patients' hearing was unchanged (41 per cent). Hearing improvement following gentamicin treatment could be secondary to decreased endolymph production by the dark cells, or it may represent fluctuation of hearing associated with Ménière's disease.

Similar hearing results have been reported by others, as depicted in Table I.[5–8] Deterioration of hearing noted at 12 months' follow up probably represents progression of the disease itself.

Jackson and Silverstein reported ototoxicity in approximately 30 per cent of their Ménière's disease patients; however, most patients who experienced hearing loss were not bothered by it and were satisfied to be free of vertigo attacks.[9] In their meta-analysis study, Cohen-Kerem *et al.* reported that hearing level and word recognition were not adversely affected regardless of gentamicin treatment regimen.[1] This finding contrasts with the results of the current study as well as those of others.[5–8]

TABLE I

REPORTED HEARING RESULTS FOLLOWING GENTAMICIN PERFUSION

Study	Pts (*n*)	Hearing results
Atlas & Parnes[5]	83	Improvement in 22 (26%) Deterioration in 14 (17%)
Minor[6]	34	Profound hearing loss in 1 (3%)
Wu & Minor[7]	34	Improvement in 5 (15%) Unchanged in 23 (68%) Deterioration in 6 (17%)
Bertino *et al.*[8]	71	Improvement in 5 (7%) Unchanged in 47 (66%) Deterioration in 19 (27%)
Current	22	Improvement in 5 (23%) Unchanged in 11 (50%) Deterioration in 6 (27%)

According to American Academy of Otolaryngology–Head and Neck Surgery criteria, hearing improvement was defined as a pure tone average (PTA) improvement of more than 10 dB and a speech discrimination score improvement of more than 15 per cent, whereas hearing deterioration was defined as a drop of 10 dB or more in the PTA and of 15 per cent or more in the speech discrimination score.

https://doi.org/10.1017/S0022215108003150 Published online by Cambridge University Press

- **Intratympanic gentamicin perfusion is an effective method for the management of Ménière's disease. However, there is inadequate evidence regarding the effect of gentamicin on hearing levels**
- **This study suggests that a significant number of patients (22.7 per cent) may experience significant hearing loss following intratympanic gentamicin**
- **Hearing deterioration noticed at 12 months' follow up probably represents progression of the disease itself**
- **The authors suggest that this modality of treatment is appropriate only for Ménière's disease patients with significant associated hearing loss**

The efficacy of this method may be compromised by the existence of round window obstruction and decreased gentamicin absorption.[10,11] A significant rate of round window obstruction exists among patients who have no history of previous surgery to this area (such as obliteration with soft tissue for putative perilymphatic fistula). For such cases, endoscopic evaluation of the round window area prior to the perfusion has been reported.[11]

The results of this study suggest that intratympanic gentamicin perfusion is effective for vertigo control; however, a significant number of patients may experience significant hearing loss. Therefore, this modality of treatment is appropriate only for Ménière's disease patients with significant associated hearing loss. Intratympanic steroids and surgical management should not be considered for Ménière's disease patients with good hearing.

References

1 Cohen-Kerem R, Kisilevsky V, Einarson TR, Kozer E, Koren G, Rutka JA. Intratympanic gentamicin for Meniere's disease: a meta-analysis. *Laryngoscope* 2004; **114**:2085–91
2 Garduno-Anaya MA, Couthino DT, Hinojosa-Gonzalez R, Pane-Pianese C, Rios-Castaneda LC. Dexamethasone inner ear perfusion by intratympanic injection in unilateral Meniere's disease: a two-year prospective, placebo-controlled, double-blind, randomized trial. *Otolaryngol Head Neck Surg* 2005;**133**:285–94
3 Longridge NS. Meta-analysis of intratympanic gentamicin. *Otol Neurotol* 2005;**26**:554
4 Committee on Hearing and Equilibrium guidelines for the diagnosis and evaluation of therapy in Meniere's disease, American Academy of Otolaryngology-Head and Neck Foundation, Inc. *Otolaryngol Head Neck Surg* 1995;**113**: 181–5
5 Atlas JT, Parnes LS. Intratympanic gentamicin titration therapy for intractable Meniere's disease. *Am J Otol* 1999;**20**:357–63
6 Minor LB. Intratympanic gentamicin for control of vertigo in Meniere's disease: vestibular signs that specify completion of therapy. *Am J Otol* 1999;**20**:209–19
7 Wu IC, Minor LB. Long-term hearing outcome in patients receiving intratympanic gentamicin for Meniere's disease. *Laryngoscope* 2003;**113**:815–20
8 Bertino G, Durso D, Manfrin M, Casati L, Mira E. Intratympanic gentamicin in monolateral Meniere's disease: our experience. *Eur Arch Otorhinolaryngol* 2006;**263**: 271–5
9 Jackson LE, Silverstein H. Chemical perfusion of the inner ear. *Otolaryngol Clin North Am* 2002;**35**:639–53
10 Silverstein H, Arruda J, Rosenberg SI, Deems D, Hester TO. Direct round window membrane application of gentamicin in the treatment of Meniere's disease. *Otolaryngol Head Neck Surg* 1999;**120**:649–55
11 Silverstein H, Rowan PT, Olds MJ, Rosenberg SI. Inner ear perfusion and the role of round window patency. *Am J Otol* 1997;**18**:586–9

Address for correspondence:
Dr Efthimios Kyrodimos,
Department of Otolaryngology-Head and Neck Surgery,
Virginia Commonwealth University Medical Center,
1201 East Marshall Street, Suite 402,
Box 980146,
Richmond, VA 23298,
USA.

E-mail: timkirodimos@hotmail.com
Fax: +1 8048285779

Dr E Kyrodimos takes responsibility for the integrity of the content of the paper.
Competing interests: None declared