

Long-term follow-up after gentamicin application via the Silverstein MicroWick in the treatment of Ménière's disease

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Abstract

We conducted a retrospective study to evaluate the long-term effectiveness of gentamicin applied directly to the round window membrane via the Silverstein MicroWick system in patients with definite or probable Ménière's disease. The study population was made up of 69 patients who had received 3 drops of gentamicin 10 mg/ml three times daily; the duration of treatment was guided by objective data obtained from weekly electronystagmography and audiometry. Relief of vertigo was assessed by chart review and telephone interviews. After a minimum follow-up of 24 months, we found that vertiginous symptoms remained controlled in 53 patients (76.8%) after one or more courses of drug therapy. A single course of treatment was successful in 41 patients (59.4%). We conclude that long-term control of vertigo can be achieved in patients with Ménière's disease by direct application of gentamicin to the round window membrane via the Silverstein MicroWick. This minimally invasive self-treatment technique was well tolerated and free of long-term complications.

Introduction

Schuknecht originally described middle ear perfusion with an aminoglycoside antibiotic for the treatment of Ménière's disease in 1956.¹ Afterward, the popularity of transtympanic methods of treating inner ear disease grew rapidly. Transtympanic treatment of Ménière's disease has several advantages: (1) it is easy to perform, (2) the surgeon can treat the affected ear directly, (3) drug can be delivered to the site of action in higher concentrations, (4) the side effects of systemic drug therapy are avoided, and (5) these procedures are much less invasive than the traditional

surgical treatments for Ménière's disease.² Transtympanic gentamicin is a widely used and effective treatment for vertigo in patients with Ménière's disease.³⁻⁶

Several methods of delivering gentamicin to the inner ear have been described in the literature, and no consensus has been reached as to which is the most effective. These methods include transtympanic injections, application of gentamicin and Gelfoam to the round window membrane, continuous perfusion through the Round Window Microcatheter (Durect Corp.; Cupertino, Calif.), and transtympanic perfusion via the Silverstein MicroWick system (Micromedics; Eaton, Minn.).⁷⁻⁹

Two types of transtympanic gentamicin dosing schedules have been described in the literature: fixed dosing and titration. The titration method relies on objective measures obtained by electronystagmography (ENG) and audiometry to guide therapy. Toth and Parnes compared the two methods and found that while they were equally effective, the titration method resulted in significantly less hearing loss.¹⁰

The Silverstein MicroWick system has been shown to be highly successful in controlling vertigo in patients with Ménière's disease. In 2002, our group reported the outcomes of 92 patients who had been treated with 3 drops of gentamicin 10 mg/ml three times daily.² The Silverstein MicroWick system delivers gentamicin in a titrated fashion, and therefore treatment was guided by weekly ENG and audiometry results; the treatment goal was to elicit a 100% reduced vestibular response (RVR) to ice air on caloric testing. Of patients who responded to a questionnaire, 85% experienced relief of vertigo, 67% experienced alleviation of aural pressure, and 57% experienced relief of tinnitus. The overall incidence of hearing loss was 36%. These results are essentially the same as those reported by others.¹¹⁻¹³ In another study, we attempted to elucidate the relationship between the level of vestibular ablation, the subsequent control of vertigo, and the risk of hearing loss with the MicroWick system.⁵

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We did find an association among these variables, and we also suggested that it might not be necessary to elicit a 100% RVR in order to achieve or maintain vertigo control. In that study, the overall vertigo control rate was 82%, the vertigo persistence rate was 9%, and the vertigo recurrence rate was 9%. All recurrent episodes occurred within 1 year.

Until now, no data have been published on *long-term* outcomes following the direct application of gentamicin to the round window membrane via the Silverstein MicroWick system in patients with Ménière's disease. The objective of this article is to report our evaluation of the MicroWick after a minimum of 24 months' follow-up in terms of vertigo control, the need for repeat treatments, the management of treatment failures, and overall patient satisfaction. The current study is a follow-up to our two earlier studies.^{2,5}

Patients and methods

We retrospectively reviewed the records of 92 patients with Ménière's disease who had been treated at a private otology/neurotology practice with gentamicin inner ear perfusion via the Silverstein MicroWick system. Patients had received 3 drops of gentamicin 10 mg/ml three times daily; the duration of titrated treatment was guided by objective data obtained from weekly ENG and audiometry, with a targeted endpoint of a 100% RVR on ice air. Specific procedural aspects of the initial treatment regimen have been described in detail elsewhere.^{2,5} In addition to patients' charts, telephone calls were also used to obtain data.

A total of 69 patients—23 men and 46 women, aged 27 to 92 years (mean: 70) at the time of follow up—met the inclusion criteria for this study. These criteria included (1) a diagnosis of Ménière's disease based on the American Academy of Otolaryngology—Head and Neck Surgery's criteria for "definite" and "probable" Ménière's disease,¹⁴ (2) treatment with the MicroWick system, (3) completion of treatment, and (4) a minimum follow-up of 24 months.

Results

The length of follow-up ranged from 24 to 68 months. The initial treatment regimen resulted in long-term vertigo control in 41 patients (59.4%) (table). The remaining 28 patients (40.6%) experienced at least one recurrence of vertigo between 1 and 40 months after the completion of initial treatment.

Of the 28 patients who had experienced a

recurrence, 21 underwent repeat gentamicin therapy and 7 went straight to surgery. Of the 21 patients who repeated drug therapy, 12 (57.1%) ultimately responded. Five of the remaining 9 underwent surgery, while the other 4 (5.8% of the entire study population) continued to try repeat drug therapy to no avail; 3 of these 4 patients subsequently developed symptoms in the other ear. By study's end, 53 of the 69 patients (76.8%) achieved long-term vertigo control with one or more courses of gentamicin therapy.

In all, 12 patients underwent surgery. The specific procedures included 6 vestibular nerve sections, 4 transcanal labyrinthectomies, and 2 transmastoid labyrinthectomies. All 12 surgical patients obtained relief of their vertigo symptoms.

Follow-up telephone interviews revealed that all 53 patients who responded to gentamicin therapy were either "satisfied" or "very satisfied" with their treatment.

Discussion

The findings of our study reinforce the evidence supporting the role of gentamicin inner ear perfusion for the treatment of vertigo in patients with Ménière's disease. Specifically, the application of gentamicin via the Silverstein MicroWick system has been shown to be consistently effective. Long-term control of vertigo symptoms was demonstrated in 76.8% of the patients in this study, all of whom reported

Table. Long-term results

	n (%)
Results of 1 course of drug treatment (n = 69)	
Vertigo controlled	41 (59.4)
Vertigo recurred	28 (40.6)
Type of treatment for recurrence (n = 28)	
Repeat drug treatment	21 (75.0)
Surgical treatment	7 (25.0)
Results of ≥2 courses of drug treatment (n = 21)	
Vertigo controlled	12 (57.1)
Vertigo recurred*	9 (42.9)
Final outcome (n = 69)	
Vertigo controlled with ≥1 courses of gentamicin	53 (76.8)
Vertigo not controlled with ≥1 courses of gentamicin, subsequently controlled with surgery	12 (17.4)
Vertigo not controlled with ≥2 courses of gentamicin	4 (5.8)

* 5 of these patients underwent successful surgery and 4 underwent further unsuccessful drug treatment.

that they were "satisfied" or "very satisfied" with their treatment. These results are consistent with our previously published work, although the rate of recurrence over the longer follow-up period was slightly higher.^{2,4,5} Even so, most of the recurrences were controlled with additional gentamicin treatments. Only 9 of the 69 patients (13.0%) were unable to achieve vertigo control after repeated gentamicin treatments. It is possible that these patients had other etiologies (e.g., autoimmune inner ear disease) that contributed to their vertigo symptoms.

Critics of this treatment may cite natural history data on Ménière's disease as the reason for the good results reported herein.^{15,16} Although this may appear to be a valid criticism, most of the patients in this study who obtained long-term relief of vertigo did so within 3 months of treatment. This treatment most likely decreases the number of vertigo recurrences as well as the length of time during which patients experience recurrences. We believe that this treatment may prevent years of unnecessary suffering from unpredictable episodes of vertigo. Moreover, the possibility that this treatment may preserve residual hearing is an interesting topic for speculation. Further studies, both clinical and histopathologic, are necessary to further elucidate these issues.

It is interesting to note that of the 12 patients (17.4%) who eventually went on to surgical intervention, most (7) did so without first attempting additional gentamicin treatment. These 7 patients may have been less tolerant of vertigo symptoms or more resistant to gentamicin treatment, or it is possible that their recurrent symptoms were more severe. Other authors have noted that the degree of RVR following gentamicin treatment is not uniform among patients.¹⁷ We also noted an element of unpredictability in eliciting RVRs in our study.

Of the 4 patients (5.8%) who did not achieve long-term vertigo control, 3 later experienced a clinical course that was characterized by fluctuating episodes of vertigo and hearing loss, multiple repeat treatments with gentamicin, temporary recovery of vestibular function after treatment, and more recurrences. These 3 patients subsequently developed symptoms in the opposite ear, and they were tentatively diagnosed with bilateral Ménière's disease or autoimmune inner ear disease. In retrospect, these patients might have been more effectively treated with steroid perfusion of the inner ear.

In conclusion, the optimal treatment paradigm for Ménière's disease has not yet been defined. Further study of both gentamicin inner ear therapy and the underlying pathogenesis of Ménière's disease may help contour future treatment. But in the meantime, gentamicin perfusion therapy via the Silverstein MicroWick system is a safe, inexpensive, and easy-to-self-administer option.

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