

Transtympanic dexamethasone application in Ménière's disease: an alternative treatment for intractable vertigo

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Abstract

The aetiology of Ménière's disease still remains unknown and its therapy is therefore empirical. As a result of immunological abnormalities demonstrated, steroids are commonly used in Ménière's disease. The place of topical steroids is still controversial. In this investigation topical dexamethasone is applied for three months through a ventilation tube in patients with intractable vertigo. The results showed that this treatment controls vertigo in 72 per cent of cases. No patient was worse than before treatment. Only in 17 per cent of the patients was there an increase in hearing level. When compared to the reports which used only tympanostomy tubes, this procedure seems to have a placebo effect with minimal harmful effects. It appears that transtympanic dexamethasone application is a good alternative to vestibular nerve section. Topical treatment may be sufficient in most patients. Systemic treatment may be used in patients where topical treatment fails.

Key words: Ménière's disease; Steroids; Transtympanic dexamethasone; Vertigo

Introduction

Even though Ménière defined the symptom complex in 1861, the aetiology of Ménière's disease still remains unknown after 137 years. Although the pathology of the disease is well established as endolymphatic hydrops, the treatment of Ménière's disease is still empirical in spite of all the recent advances.

In the last decade investigations have demonstrated immunological abnormalities in Ménière's disease. Brookes (1986) showed the presence of circulating immune complexes in 54 per cent of patients with the disease. It is believed by some investigators that there is an immune-mediated response which triggers its onset. According to Yamanobe and Harris (1993) this reaction takes place in the endolymphatic sac. Danckwardt-Lilliestrom *et al.* (1997), however, point to the stria vascularis and spiral ganglion as the place of action. Whatever the location, some authors believe that there is an immune reaction causing endolymphatic hydrops.

As a result of these advances, steroids have been used in Ménière's disease in order to decrease this immunological reaction. Systemic steroid administration is one of the current standard treatment options (Shea, 1993). The anti-inflammatory and immunosuppressive action of steroids results in

improvement of symptoms. Whether used orally or intravenously serious side-effects of steroids are well known. Locally they can be used as a dexamethasone perfusion through the round window on gel foam or a wick or suspension of methylprednisolone can be placed against the round window. Combinations of these procedures with systemic application also can be used in the treatment.

In order to decrease the side-effects of systemic steroid application, it is planned to give dexamethasone locally through a ventilation tube. This method is more practical where the patient can apply the medication himself. Here the results of transtympanic application of dexamethasone through a ventilation tube in intractable vertigo cases are presented.

Materials and methods

This prospective study was carried out in the Department of Otolaryngology – Head and Neck Surgery of Hacettepe University between 1995 and 1997, in order to investigate the efficacy of transtympanic dexamethasone application on patients with Ménière's disease. Twenty-four patients older than 20 years of age, with intractable vertigo were included in this study. Ménière's disease was diagnosed by the symptom complex; episodic ver-

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Accepted for publication: 20 November 1998.

TABLE I
AGE AND SEX DISTRIBUTION OF THE PATIENTS

Age	Male	Female	Total
20-29	3	0	3
30-39	3	4	7
40-49	5	2	7
50-59	3	0	3
60-69	1	0	1
70-79	1	2	3
Total	16	8	24

tigo, aural fullness, tinnitus and hearing loss. All patients were given medical treatment (salt and caffeine restriction, vasodilator (betahistine hydrochloride, Betaserc®), diuretic (acetazolamide, Diamox® and encouragement to eliminate nicotine) for at least six months and only those who did not benefit from this regimen and still had disabling vertigo attacks are included in this study. A detailed explanation of the study including risks, complications and possible benefits was provided to all patients. Those patients whose symptoms improved with medical treatment were not included in this study. All patients had a pure tone audiogram, speech reception threshold and speech discrimination score before, during and at the end of three month-treatment. An auditory brain-stem response (ABR) test was done initially to rule out any retrocochlear pathology. Any lesion mimicking retrocochlear pathology was ruled out by magnetic resonance imaging (MRI). The number of discrete vertiginous spells was obtained from the patients' charts. The frequency duration and severity of the attacks were noted. The effect of transtympanic dexamethasone on vertigo attacks were evaluated according to AAO-HNS 1985 criteria (Pearson and Brackmann, 1985). The two subjective symptoms; tinnitus and fullness, were also investigated. The patients were asked to rate their symptoms as an increase, decrease, total disappearance and no change.

Procedure

Ventilation tubes (Paparella silicon ventilation tube, 240046 with diameter 1.27 mm) were inserted under local anaesthesia to the lower posterior quadrant of the tympanic membrane to promote the diffusion of dexamethasone through the round window. Tubes were placed in the involved ear in unilateral cases whereas in five cases tubes were placed bilaterally in both ears. Twelve patients had their tubes in the right, and seven in the left ear. Five

TABLE II
VERTIGO CONTROL RATE

Criteria for vertigo control rate (AAO-HNS 1985)	Patients	%
Complete	10	42
Substantial	7	30
Limited	4	16.6
Insignificant	3	11.4
Worse	0	0
Total	24	100

TABLE III
CHANGES IN THE SPEECH RECEPTION THRESHOLD

	Patients	%
40 dB increase	0	0
30 dB increase	1	4.1
20 dB increase	1	4.1
10 dB increase	2	8.3
Same	11	45.8
10 dB decrease	7	29.4
20 dB decrease	2	8.3
30 dB decrease	0	0
40 dB decrease	0	0

drops of dexamethasone (Onadron® I.E. Ulagay) (containing 0.25 mg/cc) was instilled into the ear and the patient was instructed to swallow once to make the liquid enter the middle ear. Afterwards the patient was instructed to lie in the supine position, with the involved ear up, for 15 minutes. The patient continued to instil the medication five drops every other day into the involved ear/s for three months. The hearing for pure tones and speech discrimination were tested daily for the first three days and thereafter weekly by the audiology section of the same department using standard test methods.

Results

There were 16 men and eight women with intractable vertigo. Their ages ranged from 28 to 72 with the mean age being 36 years. The average duration of illness before treatment was 52 months (minimum six months–maximum seven years). Age and sex distribution of the patients are shown in Table I.

(A) Vertigo control

The results of vertigo control are summarized in Table II. Complete control was achieved in 10 patients (42 per cent) and substantial control was achieved in seven patients (30 per cent). Overall 17 patients (72 per cent) had satisfactory relief from vertigo. No patient was worse than before treatment. In 15 patients (63 per cent) vertigo control was achieved within the first month, in six patients (25 per cent) in the second month. In three patients (12 per cent) no control could be achieved.

(B) Hearing results

There was an increase in hearing level in four patients (17 per cent) whereas nine patients (37 per cent) showed a decrease in PTA average (Table III). There was no change in the hearing level before and after treatment in 11 patients (46 per cent) of the cases. When the hearing changes before and after

TABLE IV
SPEECH DISCRIMINATION (SD) SCORE CHANGES

SD Scores	Patients	%
15% increase	3	12.4
same	17	71
15% decrease	4	16.6
Total	24	100

TABLE V
VERTIGO CONTROL AND HEARING LOSS CONFIGURATION

Hearing loss configuration	Patients	Complete	Substantial	Limited	Insignificant	Worse
Lower tones	15	6	4	3	2	0
Higher tones	1	0	0	1	0	0
Flat	8	4	3	0	1	0
Total	24	10	7	4	3	0

treatment were examined (Figure 1), there was no statistically significant change for 250 Hz, 500 Hz, 1000 Hz and 2000 Hz. The speech discrimination score remained the same in 17 patients (71 per cent), three patients (12 per cent) showed a 15 per cent increase, while four patients (17 per cent) showed the same amount of decrease (Table IV). When the hearing loss configuration was taken into consideration (Table V), seven patients (88 per cent) with flat-type hearing loss demonstrated satisfactory vertigo control. With low tone hearing loss, however, only 10 patients (67 per cent) showed satisfactory control.

(C) Tinnitus

Two patients (eight per cent) showed complete relief from tinnitus and 10 patients (42 per cent) decrease in tinnitus (Table VI). There was no change in tinnitus in the remaining 12 patients (50 per cent).

(D) Fullness

The results of fullness changes are shown in Table VII. Six patients (25 per cent) had complete relief from fullness, 12 patients (50 per cent) showed decrease and there was no change in the remaining six patients (25 per cent).

(E) Complications

One patient had otitis media during the second month of treatment which necessitated the removal of the ventilation tube. All perforations but one closed within two weeks after removal. The perforation which persisted for a month was closed with paper patch application.

Discussion

The most important finding in this investigation is that transtympanic dexamethasone application is effective in relieving the vertigo in 72 per cent of intractable vertigo cases. Normally these patients are candidates for vestibular nerve section. It appears that this procedure is a good alternative to an intracranial surgery which is difficult for an ordinary

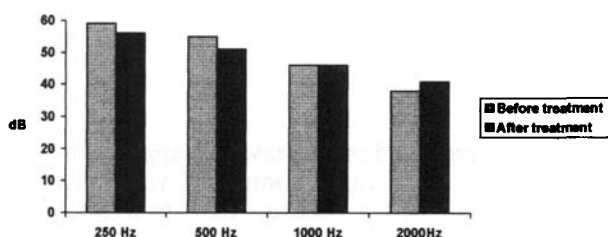


FIG. 1

Hearing levels before and after treatment.

ENT surgeon to perform, requires special training, is potentially dangerous and does nothing to improve hearing loss, fullness and tinnitus. When compared to the studies which used only ventilation tubes without any medication in intractable vertigo cases (Tumarkin, 1966; Montandon *et al.*, 1988; Kimura and Dutta, 1997), there is a likelihood of a placebo effect of this treatment with minimal harmful side-effects in Ménière's disease.

What is the aetiology of Ménière's disease? Is there a place for steroids in the treatment of Ménière's disease? The answers to these questions are not known at present. We do know, however, that histopathological changes occur in the cochlea when animals undergo steroid depletion. Lohuis *et al.* (1990) demonstrated that the cellular structure of the stria vascularis underwent atrophy after removal of adrenal steroids and Rarey *et al.* (1991) showed that it returned to normal after administration of adrenocorticoids. Both of these experiments demonstrate that there is a role for steroids in the maintenance of normal functions of the stria vascularis.

What is the role of immunology in the aetiology of Ménière's disease? In the last decade numerous articles demonstrating the relation of immunological abnormalities and Ménière's disease appeared in the literature. Brookes (1986) demonstrated the presence of circulating immune complexes in 54 per cent in patients with Ménière's disease. Suzuki and Kitahara (1992) found severe immunological abnormalities in 16 per cent of bilateral cases and two per cent of unilateral cases. Gutierrez *et al.* (1994) showed that patients with endolymphatic hydrops had elevated levels of a circulating immune complex of IgG and lowered levels of functional complement activity. Yoo *et al.* (1984) also demonstrated higher levels of antibodies to type II collagen in patients with Ménière's disease.

Steroid treatment is not new in Ménière's disease. Until recently steroids have been mostly administered orally or intravenously. Oral and intravenous steroid treatment, although very easy to use, has well-known side-effects in the long-term. According to Nadel (1996) these side-effects are susceptibility to infection, diabetes, osteoporosis, peptic ulcer, hypertension, psychological changes, myopathy,

TABLE VI
TINNITUS CHANGES

Tinnitus	Patients	%
Total disappearance	2	8
Decrease	10	42
Same	12	50

TABLE VII
EFFECT OF STEROIDS ON FULLNESS

Fullness	Patients	%
Increase	0	0
Same	6	25
Decrease	12	50
Total disappearance	6	25
Total	24	100

ocular effects, impaired wound healing and avascular necrosis. Therefore, they must be used very cautiously and only when there is absolute necessity.

Local steroids can be applied in different forms. Itoh and Sakata (1991) described intratympanic dexamethasone injection into the middle ear. Shea (1993) reported dexamethasone perfusion of the labyrinth after laser-assisted myringotomy. He used this procedure simultaneously with i.v. dexamethasone. Silverstein *et al.* (1996) reported the use of endoscopes to open the fibrotic bands in the region of round window in order to enhance the absorption of methylprednisolone acetate suspension through the round window. Although they do not produce the side-effects of systemic application these procedures have some disadvantages. They require general anaesthesia and solutions can be applied as long as the myringotomy incision is open. If unsuccessful the operation or the injection of steroids should be repeated.

Transtympanic topical steroid application through a ventilation tube is both practical and easy. The medication easily reaches middle ear through the ventilation tube where it can be absorbed through the round window. In order to promote inward movement of the fluid the patient is taught to swallow with the nose blocked. The tube is placed in the lower posterior quadrant of the tympanic membrane to promote the diffusion through the round window.

The advantages of this administration route are:

- (1) no systemic side effects;
- (2) the patient can use the medication himself without the assistance of a medical team;
- (3) it can be easily performed under local anaesthesia;
- (4) if vertiginous attacks start again medication can be started immediately.

The disadvantages of this method are infection which makes topical steroid application impossible. This complication was present in one of our patients and it required the termination of treatment. The perforations usually healed within two weeks. Only one patient had a persistent perforation which required paper patch application.

In our study transtympanic dexamethasone application controlled vertigo in 72 per cent of the patients. Itoh and Sakata (1991) who used the injection method reported similar results. Although this method was used in two patients with vertigo Silverstein *et al.* (1996) found it to be unsuccessful. Shea and Ge (1996) reported 96 per cent relief of vertigo by dexamethasone perfusion. As our patients are only intractable vertigo cases, it is difficult to

compare the results because the percentage of intractable vertigo among Shea and Ge patients is not known.

How long are we going to use this treatment? The answer is not precisely known. In our investigation dexamethasone drops were applied for three months. Silverstein *et al.* (1996) used the drops for one month in cases with inner ear disease. The procedure used in our department is to leave the tympanostomy tubes in place for one year. At the end of this time if no further vertigo attacks are present they are removed. More experience is required in order to decide the exact duration of treatment.

Our hearing results are not as good as reported in the literature. Shea and Ge (1996) report a 68 per cent improvement in hearing loss, 82 per cent in tinnitus and 89 per cent in fullness. Silverstein *et al.* (1996) reports a 45 per cent improvement in tinnitus and 43 per cent in hearing loss. Our results are 17 per cent improvement in hearing loss, 50 per cent in tinnitus and 75 per cent in fullness. Again it is difficult to compare the results because our patients are only intractable vertigo cases.

One of the reasons of failure to control vertigo may be the fibrous adhesion around the round window as indicated by Silverstein *et al.* (1996). It may be more appropriate to use otoendoscopes to diagnose and remove these bands and improve the absorption of dexamethasone.

One other important result is that not all patients require systemic treatment. Topical treatment may be sufficient for most patients. Systemic steroid treatment or vestibular nerve section can be used in patients where topical treatment fails.

With the hope of diminishing middle ear pressure changes in patients with Eustachian tube dysfunction and Ménière's syndrome, Tumarkin (1966) tried to treat this condition by inserting ventilation tubes. Montandon *et al.* (1988) reported that by inserting a ventilation tube in the affected ear vertigo attacks were prevented in 71 per cent and reduced in frequency in 11 per cent, although they said that they had no explanation for this finding. In our study intratympanic steroid application relieved vertigo in 72 per cent of intractable vertigo cases. When these values are compared they show the importance of the placebo effect. Kimura and Hutta (1997) in a recent animal study demonstrated that it was possible to prevent hydrops by introducing middle-ear ventilation. Taking the placebo effect into consideration it may be concluded that in intractable vertigo cases initially only a ventilation tube should be used. If the attacks persist steroids can then be used.

Conclusions

Transtympanic dexamethasone application in intractable vertigo cases controlled vertigo in 72 per cent of Ménière's disease. Apart from infection (five per cent) this method had no serious side-effects. It appears to be a good alternative to vestibular nerve section which is difficult for an

ordinary ENT surgeon to perform, requires special training, is potentially dangerous and does not improve hearing loss, fullness and tinnitus. Taking the placebo effect into consideration it may be suggested ventilation tube insertion is used first and later steroid application if the vertigo still persists. Systemic treatment or vestibular nerve section can be used in patients where topical treatment fails.

References

- Brookes, G. B. (1986) Circulating immune complexes in Ménière's disease. *Archives of Otolaryngology – Head and Neck Surgery* **112**: 536–540.
- Danckwardt-Lilliestrom, N., Friberg, U., Kinnertors, A. (1997) Endolymphatic sacitis in a case of active Ménière's disease. A TEM histopathological investigation. *Annals of Otolaryngology, Rhinology and Laryngology* **106**(3): 190–198.
- Gutierrez, F., Moreno, P. M., Sainz, M. (1994) Relationship between immune complex and total hemolytic complement in endolymphatic hydrops. *Laryngoscope* **104**: 1495–1498.
- Itoh, A., Sakata, E. (1991) Treatment of vestibular disorders. *Acta Otolaryngologica (Stockh)* **481**: 617–623.
- Kimura, R. S., Hutta, J. (1997) Inhibition of experimentally induced endolymphatic hydrops by middle ear ventilation. *European Archives of Otorhinolaryngology* **254**: 213–218.
- Lohuis, P. J., ten Cate, W. J., Patterson, K. E. (1990) Modulation of rat stria vascularis in the absence of circulating adrenocorticosteroids. *Acta Otolaryngologica (Stockh)* **110**: 348–356.
- Montandon, P., Guillemin, P., Hausler, R. (1988) Prevention of vertigo in Ménière's syndrome by means of transtympanic ventilation tubes. *ORL* **50**: 377–381.
- Nadel, D. M. (1996) The use of systemic steroids in otolaryngology. *Ear, Nose and Throat Journal* **75**: 502–516.
- Pearson, B., Brackmann, D. E. (1985) Committee on hearing and equilibrium guidelines for reporting treatment results in Ménière's disease. *Otolaryngology – Head and Neck Surgery* **96**: 83–95.
- Rarey, K. E., Lohuis, P. J. F. M., ten Cate, W. J. F. (1991) Response of stria vascularis to corticosteroids. *Laryngoscope* **101**: 1081–1084.
- Shea, J. J. (1993) Classification of Ménière's disease. *American Journal of Otolaryngology* **4**: 224–229.
- Shea, J. J., Ge, X. (1996) Dexamethasone perfusion of the labyrinth plus intravenous dexamethasone for Ménière's disease. *Otolaryngologic Clinics of North America* **29**: 353–358.
- Silverstein, H., Choo, D., Rosenberg, S., Kuhn, J. (1996) Intratympanic steroid treatment of inner ear disease and tinnitus (Preliminary report). *Ear, Nose and Throat Journal* **75**: 468–488.
- Suzuki, M., Kitahara, M. (1992) Immunologic abnormality in Ménière's disease. *Otolaryngology – Head and Neck Surgery* **107**: 57–62.
- Tumarkin, A. (1966) Thoughts on the treatment of labyrinthopathy. *Journal of Laryngology and Otolaryngology* **80**: 1041–1053.
- Yamanobe, S., Harris, J. P. (1993) Inner ear specific antibodies. *Laryngoscope* **103**: 319–325.
- Yoo, T. J. (1984) Etiopathogenesis of Ménière's disease. A hypothesis. *Annals of Otolaryngology, Rhinology and Laryngology (Suppl 113)* **93**: 6–12.

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