Long-term prognosis of hearing loss in patients with unilateral Ménière’s disease

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Abstract

Conclusion: The finding of deteriorated hearing loss at the initial visit at middle to high frequencies is a factor of poor hearing prognosis in Ménière’s disease. Early intervention with instructions for lifestyle changes may lead to good outcomes in hearing.

Objective: An attempt was made to examine long-term changes in hearing loss in unilateral Ménière’s disease and factors associated with prognosis of hearing loss retrospectively.

Methods: Based on their last hearing level of the affected ear, 36 patients were subdivided into two groups: the poor prognosis of hearing (PPH) group and the good prognosis of hearing (GPH) group.

Results: In the PPH group, the hearing levels at the initial visit at middle and high frequencies were significantly worse than those in the GPH group. Moreover, the hearing loss progressed during the first 2 years of the disease, and stayed flat to approximately 50 dB at the later stage. Conversely, the hearing loss at the onset in the GPH group showed no further progression over the first 2 years, and remained constant to approximately 35 dB at the later stage. In addition, the mean intervals from the onset to the initial visit in the PPH group were significantly longer than those in the GPH group.

Keywords: Endolymphatic hydrops, vertigo attack, early intervention

Introduction

Ménière’s disease is an intractable inner ear disease that is characterized by episodes of recurrent vertigo with hearing loss, tinnitus, and aural fullness. Its pathophysiology is recognized to be idiopathic endolymphatic hydrops [1,2].

Previous studies reported that in most patients with Ménière’s disease, the frequency of vertigo attacks decreased gradually after the onset until it reached a steady-state phase free of vertigo [3,4]. On the other hand, it was also reported that sensorineural hearing loss in Ménière’s disease deteriorated progressively until it reached a moderate or severe level [5–7]. Since the vertigo attacks decrease or disappear in the long-term course, the goal of treatment for Ménière’s disease should be to prevent the progression of hearing loss that causes a reduction in the quality of life in the patients [4,8,9].

In the present study, an attempt was made to retrospectively examine long-term changes in hearing loss during follow-up in patients with unilateral Ménière’s disease. We divided the patients into two groups based on their last hearing level of the affected ear: (1) the poor prognosis of hearing (PPH) group and (2) the good prognosis of hearing (GPH) group, and then investigated the factors associated with the prognosis of hearing loss.

Material and methods

A total of 36 patients (14 males and 22 females; 24–75 years old; mean age 47.6 ± 13.3 years) with unilateral definite Ménière’s disease according to
the 1995 guidelines of the American Academy of Otorhinolaryngology and Head and Neck Surgery (AAO-HNS) were included in the present study (Table I) [10]. They were referred to University Hospital from private ENT clinics, because of their intractable Ménière’s attacks.

The onset of Ménérie’s disease was determined by detailed interview at the initial visit to the hospital. After the initial visit, hearing levels were evaluated and the frequency of vertigo attacks was requested at each follow-up visit. The mean follow-up period was 49.2 ± 34.3 months after the initial visit to University Hospital. In 17 patients, their referrals reported the audiograms containing hearing level at the onset of the disease. This retrospective study was approved by the Committee for Medical Ethics of Tokushima University Hospital.

According to a grading system to assess the severity of symptoms in patients with Ménérie’s disease proposed by the Intractable Vestibular Disorder Committee of the Ministry of Health and Welfare of Japan, the patients were subdivided into two groups based on their last hearing level of the affected ear: (1) the poor prognosis of hearing (PPH) group, whose hearing levels were over 40 dB in all 125, 250, 500, 1000, 2000, 4000, and 8000 Hz; (2) the good prognosis of hearing (GPH) group, whose hearing levels were lower than 40 dB in at least one of 125, 250, 500, 1000, 2000, 4000, and 8000 Hz.

The averaged hearing levels were calculated every 3 months and changes in hearing levels at every 3-months period after the onset of the disease were lower than 40 dB in at least one of 125, 250, 500, 1000, 2000, 4000, and 8000 Hz.

The mean hearing levels at the initial visit to the hospital in Ménérie’s patients with PPH were 48.0 ± 19.8 dB at low frequency, 41.8 ± 18.7 dB at middle frequency, and 45.6 ± 15.2 dB at high frequency, while in those with GPH, they were 40.3 ± 14.1 dB, 28.9 ± 11.3 dB, and 32.4 ± 11.9 dB, respectively (Table I). Thus the mean hearing levels at the initial visit in patients with PPH at middle and high frequencies, but not at low frequencies, were significantly worse than those in patients with GPH.

In patients with PPH, the mean hearing levels at the onset of the disease that were reported in their referrals at low, middle, and high frequencies were 39.3 ± 12.7 dB, 31.2 ± 8.5 dB, and 38.8 ± 8.6 dB, respectively. Two years after the onset, they deteriorated rapidly to 53.5 ± 22.2 dB, 50.9 ± 21.7 dB, and 51.1 ± 16.3 dB before stabilizing, respectively, at 44.4 ± 5.9 dB, 50.6 ± 7.9 dB, and 59.4 ± 6.7 dB 8 years later (Figure 1). On the other hand, in patients with GPH, the mean hearing levels at the onset of the disease that were reported in their referrals at the same frequencies were 39.8 ± 15.1 dB, 26.5 ± 10.7 dB, and 30.3 ± 11.3 dB, respectively. Two years after the onset, they deteriorated slightly to 44.3 ± 13.4 dB, 33.8 ± 10.2 dB, and 35.7 ± 11.9 dB, and then became stable at 35.8 ± 27.1 dB, 34.2 ± 24.6 dB, and 34.2 ± 5.9 dB, respectively, 8 years later (Figure 2).

The mean progression of hearing levels during vertigo attacks was significantly larger than that after vertigo in patients with both PPH and GPH (Figure 3). The mean progressions of hearing levels during vertigo attack in patients with PGH and GPH was estimated by the formula of the averaged hearing level of 125–8000 Hz at the 3-month period when patients experienced vertigo attacks minus the averaged level of the pre-vertigo attack period. The progression of hearing levels after vertigo attack was estimated by subtracting the averaged hearing level between 125 and 8000 Hz at the 3-month period when patients experienced vertigo attacks from that of the post-vertigo attack period.

After the initial visit, the patients received betahistine and/or anti-emetic during a vertigo attack, and isosorbide, an osmotic diuretic, for at least 3 months after a vertigo attack. They also received instructions to avoid mental and physical stress in their lifestyle. Patients who underwent surgery such as endolymphatic sac surgery and intratympanic injection with gentamicin were excluded from the present study.

The Mann–Whitney test was used for statistical analysis and $p < 0.05$ was considered statistically significant.

### Results

The mean hearing levels at the initial visit to the hospital in Ménérie’s patients with PPH were $48.0 \pm 19.8$ dB at low frequency, $41.8 \pm 18.7$ dB at middle frequency, and $45.6 \pm 15.2$ dB at high frequency, while in those with GPH, they were $40.3 \pm 14.1$ dB, $28.9 \pm 11.3$ dB, and $32.4 \pm 11.9$ dB, respectively (Table I).

#### Table I. Patients with unilateral Ménérie’s disease at the initial visit.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>PPH group $(n = 19)$</th>
<th>GPH group $(n = 17)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (years)</td>
<td>$47.1 \pm 13.3$</td>
<td>$46.8 \pm 16.4$</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (%)</td>
<td>6 (32)</td>
<td>8 (47)</td>
</tr>
<tr>
<td>Female (%)</td>
<td>13 (68)</td>
<td>9 (53)</td>
</tr>
<tr>
<td>Mean hearing level at low frequencies (dB)</td>
<td>$48.0 \pm 19.8$</td>
<td>$40.3 \pm 14.1$</td>
</tr>
<tr>
<td>Mean hearing level at middle frequencies (dB)</td>
<td>$41.8 \pm 18.7^*$</td>
<td>$28.9 \pm 11.3$</td>
</tr>
<tr>
<td>Mean hearing level at high frequencies (dB)</td>
<td>$45.6 \pm 15.2^*$</td>
<td>$32.4 \pm 11.9$</td>
</tr>
</tbody>
</table>

Values are shown as mean ± SD. GPH, good prognosis of hearing; PPH, poor prognosis of hearing. 

$^* p < 0.05$. 


were $3.3 \pm 11.4$ dB and $2.6 \pm 11.9$ dB, respectively. After vertigo attacks, the mean progression of hearing levels in patients with PPH was $0.48 \pm 11.6$ dB, whereas that of those with GPH was $-3.6 \pm 10.5$ dB, indicating an improvement of hearing levels after vertigo attacks.

The percentage of patients who suffered from vertigo attacks every 3 months decreased rapidly
during the first 3 years after the onset of the disease in both PPH and GPH groups, and then 8 years later stabilized at less than 20% (Figure 4). The mean interval from the onset to the initial visit in patients with PPH (15.5 ± 18.7 months) was significantly longer as compared with that of those with GPH (7.6 ± 11.7 months) (Figure 5).

**Discussion**

In the present study, the mean hearing levels at the initial visit to the hospital in Ménière’s patients with PPH were significantly worse than those with GPH at middle and high frequencies but not at low frequencies. It is suggested that the deteriorated hearing loss at the initial visit at middle to high frequencies is a factor of poor prognosis of the hearing loss in patients with Ménière’s disease, because the hearing loss at low frequencies is fluctuating and reversible at the early stage of the disease [5] and that at high frequencies tends to be irreversible and progressive [6,7].

The present study also showed that in patients with PPH, the hearing loss progressed during the first 2 years after the onset of the disease, and stayed flat to approximately 50 dB at the later stage of Ménière’s disease. Conversely, the hearing loss at the onset in patients with GPH showed no further progression over the first 2 years, and became constant to approximately 35 dB at the later stage of the disease. These findings suggest that the rapid progression of hearing loss during the first 2 years leads to poor hearing outcomes in patients with Ménière’s disease. Indeed, many studies found that the hearing loss in Ménière’s disease deteriorated over time within the first several years of the disease and was followed by a stabilization of moderate to severe hearing loss [4,12,13]. Thomas and Harrison reported that the progression of hearing loss was more
common during the first 5 years [12], whereas Stahle reported it to occur within the first 2 years [13].

During follow-up, the mean hearing levels worsened by about 3 dB during the vertigo attacks in Ménieré's patients with both PPH and GPH. However, the deteriorated hearing loss of 3 dB improved after the vertigo attack in patients with GPH but not in those with PPH. It is possible that the progression of hearing loss during vertigo attacks became irreversible in patients with PPH who suffered from repeated vertigo attacks. This is because an intractable vertigo attack was suggested to be a factor for poor hearing prognosis, based on the findings that hearing loss took place in the early course of Ménieré's disease before the relief in vertigo attack [3,4]. However, the possibility is unlikely, because the present study showed that the percentages of patients who suffered from a vertigo attack every 3 months decreased rapidly during the first 3 years after onset of the disease and that there were no differences in these percentages between patients with PPH and those with GPH. Previous studies also reported that the frequency of vertigo attacks decreased over time in most patients with Ménieré's disease [14]. Perez-Garrigues et al. also reported that the frequency of vertigo attacks showed a rapid decline during the first 8 years of the disease [3]. Thus, the frequency of vertigo attack seems to have little effect on hearing prognosis of Ménieré's disease. It is suggested that hydrops itself, but not the rupture of hydrops, leads to hair cell degeneration, because a vertigo attack in Ménieré's disease is induced by its rupture [15].

Another possibility of the irreversible progression of hearing levels during the vertigo attack in patients with PPH is the higher susceptibility of their inner ear to endolymphatic hydrops. Recently, Moon, et al. reported that a high SP/AP ratio on electrocochleogram was a predictor of poor hearing outcomes in patients with Ménieré's disease and suggested that excessive endolymphatic hydrops associated with a high SP/AP ratio led to hair cell degeneration and malfunction [16]. Therefore, the inner ear of patients with PPH may be more susceptible to endolymphatic hydrops than that of those with GPH.

In the present study, patients with GPH visited the hospital and were treated significantly earlier than those with PPH, suggesting that early intervention is effective in preventing the progression of hearing loss in patients with Ménieré's disease. Patients received isosorbide, an osmotic diuretic, for at least 3 months after vertigo attack, because a Japanese randomized controlled trial showed that isosorbide was more effective in suppressing vertiginous symptoms than betahistine, but had no effect on hearing loss in patients with Ménieré's disease [17].

Contradicting this observation, the Cochrane Library indicates that no good evidence regarding the effect of diuretics on Ménieré's disease has been previously reported [18]. Therefore, the good prognosis of hearing associated with the early intervention may not be due to the treatment with osmotic diuretic. On the other hand, in the present study, patients with Ménieré's disease also received the instruction to operate changes in their lifestyle, especially to avoid mental and physical stress, because Ménieré's disease is recognized as a stress-induced disease [7]. Indeed, it has been reported that counseling is more effective in improving the hearing level in patients with Ménieré's disease than drug treatment [19], suggesting that it decreases levels of stress hormones such as vasopressin, which increases the extent of endolymphatic hydrops [20]. Therefore, it is suggested that early intervention with instructions for changes in lifestyle leads to good outcomes of hearing in patients with Ménieré's disease.

Conclusion

In the present study, we showed that the deteriorated hearing loss at the initial visit at middle and high frequencies is a factor for poor hearing prognosis in patients with Ménieré's disease. The hearing loss further progressed over the first 2 years, and stayed flat at approximately 50 dB later, indicating poor outcomes of hearing. In Ménieré's patients with PPH, the hearing level worsened by about 3 dB during vertigo attacks, after which the loss was irreversible. Because the frequency of vertigo attacks in patients with PPH was not different from that of those with GPH, it is suggested that the inner ear in patients with PPH is more susceptible to endolymphatic hydrops. Conversely, the hearing loss in patients with GPH did not progress after the onset, probably because the mean interval from the onset to the initial visit to the hospital in patients with GPH was shorter than that of those with GPH, indicating the need for early intervention with instructions for changes in lifestyle. This may lead to reducing the extent of endolymphatic hydrops and to good outcomes of hearing in patients with Ménieré’s disease.

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