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Negative prognostic factors for psychological conditions in patients with audiovestibular diseases

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ABSTRACT

Objective: To examine the backgrounds of patients with audiovestibular disease regarding what influences their psychological state.

Methods: During a 12-year period, 375 successive patients with audiovestibular diseases were enrolled in this study. Diseases included unilateral ($n = 174$) and bilateral ($n = 51$) Menière's disease, sudden deafness with vertigo ($n = 70$), and vestibular neuritis ($n = 80$). Diagnosis, sex, age, duration of disease, vertigo frequency, persistent nystagmus, and ipsilateral/contralateral hearing levels were recorded. Cornell Medical Index (domains III–IV = neurosis) and Self-Rating Depression Scale (score > 40 = depression) were applied during acute vertigo remissions in all patients.

Results: Neurosis and depression, respectively, were diagnosed in 62.7% and 82.4% of bilateral Menière's, 32.7% and 48.9% of unilateral Menière's, 15.7% and 38.6% of sudden deafness/vertigo, and 12.7% and 31.3% of vestibular neuritis patients. Multivariable logistic regression analysis showed that Menière's disease with longer disease duration (Oz 1.212; $P = 0.021$) and worse hearing in the secondary affected ear (Oz 1.131; $P = 0.042$); sudden deafness/vertigo with persistent nystagmus (Oz 1.895; $P = 0.005$); and vestibular neuritis with longer disease duration (Oz 1.422; $P = 0.019$) and persistent nystagmus (Oz 1.950; $P = 0.0003$) had mental illness significantly more often than those with shorter-duration disease, better hearing and no persistent nystagmus.

Conclusion: Mental disorder increased in accordance with solo vertigo, vertigo/hearing loss, repeated symptoms, and bilateral lesions. Treatment strategies should be carefully constructed for patients with persistent nystagmus, long disease duration, and hearing loss in the secondary affected ear to avoid psychological disorders.

1. Introduction

We often find neurosis and/or depression in patients with audiovestibular diseases at the daily ear-nose-throat clinic. In previous studies, patients with Menière's disease [1] and those with vestibular schwannoma [2] developed mental illness in accordance with hearing impairment on the contralateral side (i.e., in the better-hearing ear). Mental problems in these patients may hinder good communication between patients and physicians. Mental health care is thought to play an important role in good therapeutic compliance, resulting in effective medical [3,4] and surgical [5] results.

To treat patients with intractable audiovestibular diseases effectively, we need to understand the psychological condition of each patient [6,7]. In this study, we first examined the state of neurosis and depression in these patients using the Cornell

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Medical Index (CMI) and the Self-Rating Depression Scale (SDS). We then examined the correlation between the patient's mental state and his or her background.

2. Materials and methods

The Hospital Ethics Committee approved the study (certificate number 0421). It is registered by ClinicalTrials.gov of the US Food and Drug Administration (certificate number NCT00500474).

Between April 1998 and March 2010, a total of 375 successive patients with audiovestibular diseases were enrolled in the present study at our hospital. Their diagnoses included the following.

- Vestibular neuritis (disease category 1): $n = 80$; M38, F42; age 45.7 ± 13.3 years; duration of disease 26.4 ± 16.8 months; vertigo frequency 0.0 ± 0.0/month; persistent nystagmus (+) $n = 20$, (−) $n = 60$; ipsilateral hearing 15.5 ± 6.7 dB; contralateral hearing 13.2 ± 6.8 dB.
- Sudden deafness with vertigo (disease category 2): $n = 70$; M32, F38; age 49.8 ± 12.9 years; duration of disease 25.8 ± 31.9 months; vertigo frequency 0.0 ± 0.0/month; persistent nystagmus (+) $n = 16$, (−) $n = 54$; ipsilateral hearing 61.1 ± 21.4 dB; contralateral hearing 14.1 ± 7.0 dB.
- Unilateral Menière's disease (disease category 3): $n = 174$; M85, F89; age 48.3 ± 13.7 years; duration of disease 65.9 ± 49.9 months; vertigo frequency 1.8 ± 1.1 times/month; persistent nystagmus (+) $n = 53$, (−) $n = 121$; ipsilateral hearing 55.0 ± 18.2 dB; contralateral hearing 11.9 ± 6.9 dB.
- Bilateral Menière's disease (disease category 4): $n = 51$; M23, F28; age 53.5 ± 9.9 years; duration of disease 89.3 ± 46.7 months; vertigo frequency 1.4 ± 0.9 times/month; persistent nystagmus (+) $n = 19$, (−) $n = 32$; ipsilateral hearing 59.2 ± 15.5 dB; contralateral hearing 54.0 ± 8.4 dB.

Menière's disease [8], sudden deafness with vertigo [9], and vestibular neuritis [10] were diagnosed according to criteria described previously. Diagnosis, sex, age, duration of disease, vertigo frequency (the number of attacks during the last 6 months), persistent nystagmus (at least five rhythmical consecutive beats of positional/positioning and/or head shaking after nystagmus under an infrared CCD camera (Daiichi Seiko, Ogori, Japan)), and the ipsilateral and contralateral hearing levels at their first visit were included in the records of the patients' backgrounds.

We applied the CMI and SDS during remission of acute vertigo attacks in all of the patients to evaluate their psychological status. CMI domains III and IV were defined as neurosis [11] and SDS scores of >40 as depression [12].

All statistical analyses were performed using Statistical Package for the Social Sciences, version 14.0 (SPSS, Chicago, IL, USA). The Kruskal–Wallis and Mann–Whitney tests were used to compare the rates of patients with psychological disturbance associated with each of the diseases (Figs. 1 and 2). Univariate regression analysis was used to identify statistically

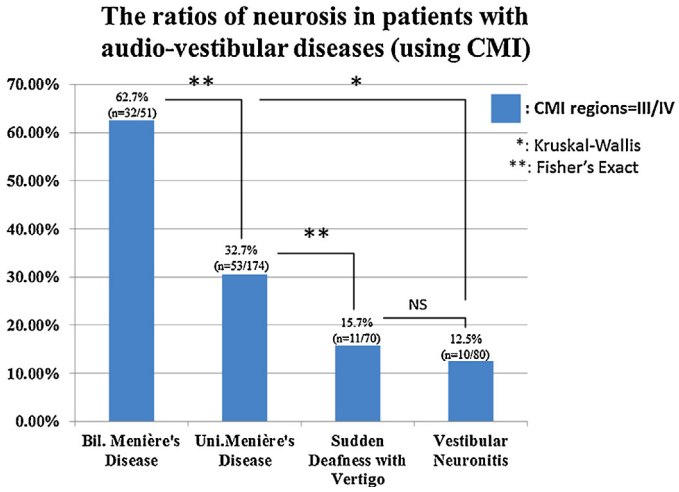

Fig. 1. Neurosis diagnosed by the Cornell Medical Index (CMI). Neurosis was diagnosed by CMI in the III and IV regions (bars) in 62.7% (32/51) of patients with bilateral (Bil.) Menière's disease, in 32.7% (53/174) of patients with unilateral (Uni.) Menière's disease, in 15.7% (11/70) of patients who had sudden deafness with vertigo, and in 12.5% (10/80) of patients with vestibular neuritis.

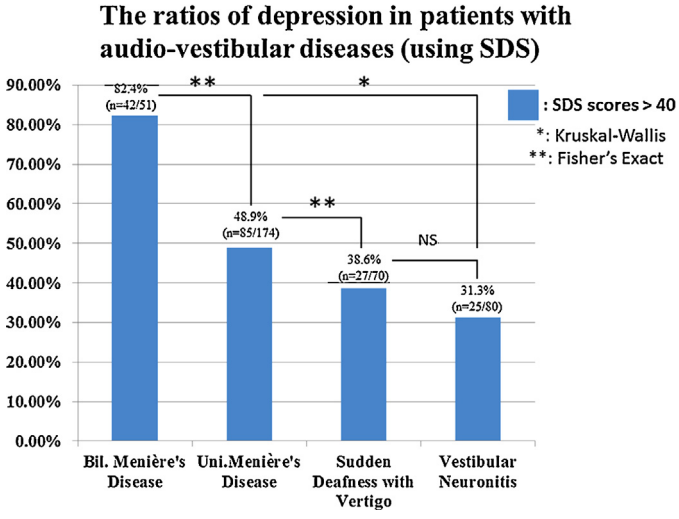

Fig. 2. Depression diagnosed by the Self-Rating Depression Scale (SDS). Depression was diagnosed by an SDS score of >40 (bars) in 82.4% (42/51) of patients with bilateral (Bil.) Menière's disease, in 48.9% (85/174) of patients with unilateral (Uni.) Menière's disease, in 38.6% (27/70) of patients who had sudden deafness with vertigo, and in 31.3% (25/80) of patients with vestibular neuritis.

significant demographic variables (Tables 1–5). Multivariate regression analysis was used to determine which factor was the most significant contributor to psychological state (Tables 1–5). The level of statistical significance was set at $P < 0.05$ for the Kruskal–Wallis, Mann–Whitney, and multivariate regression analyses. For the univariate analyses, $P < 0.1$ was considered tending toward significance.

3. Results

As seen in Fig. 1, neurosis was diagnosed by CMI in 62.7% (32/51) of patients with bilateral Menière's disease, in 32.7%

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Table 1
CMI logistical regression analysis of three audiovestibular diseases (Menière's disease, sudden deafness with vertigo, vestibular neuritis).

Parameter	*P*	Oz ratio (95% CI)
Univariable analysis		
Disease categories 1–4	**0.0001**	**1.663 (0.817–2.501)**
Sex	0.323	0.445 (0.025–0.658)
Age	0.570	0.985 (0.591–1.434)
Disease duration	**0.001**	**1.252 (1.050–1.375)**
Vertigo frequency	**0.001**	**1.050 (0.974–1.026)**
PN/DH/HN	**0.0001**	**1.750 (0.855–2.775)**
Initial hearing level	0.159	0.832 (0.509–1.100)
Secondary hearing level	**0.005**	**1.151 (1.060–1.347)**
Worse hearing level	**0.029**	**1.039 (0.904–1.233)**
Better hearing level	**0.005**	**1.155 (1.017–1.354)**
Multivariable analysis		
Disease categories 1–4	**0.041**	**1.652 (0.852–3.030)**
Disease duration	0.055	1.022 (1.004–1.069)
PN/DH/HN	**0.0001**	**1.840 (1.021–2.856)**

CMI, Cornell Medical Index; CI, confidence interval; PN, positional nystagmus; DH, Dix–Hallpike positioning nystagmus; HN, head shaking after nystagmus.
Boldface type and underlined factors indicate statistical significance: $P < 0.1$ in the univariable analysis and $P < 0.05$ in the multivariable analysis.

Table 2
SDS logistical regression analysis of three audiovestibular diseases (Menière's disease, sudden deafness with vertigo, vestibular neuritis).

Parameter	*P*	Oz ratio (95% CI)
Univariable analysis		
Disease categories 1–4	**0.0001**	**1.463 (0.835–2.262)**
Sex	0.151	1.463 (0.835–2.562)
Age	0.109	1.150 (0.899–1.411)
Disease duration	**0.005**	**1.122 (1.054–1.194)**
Vertigo frequency	**0.002**	**1.010 (0.929–1.221)**
PN/DH/HN	**0.0001**	**1.955 (1.646–2.325)**
Initial hearing level	0.116	0.900 (0.723–1.128)
Secondary hearing level	**0.005**	**1.081 (1.026–1.147)**
Worse hearing level	**0.026**	**1.022 (0.895–1.252)**
Better hearing level	**0.005**	**1.093 (1.035–1.135)**
Multivariable analysis		
Disease categories 1–4	0.061	1.183 (0.188–2.046)
Disease duration	0.079	1.121 (1.050–1.194)
PN/DH/HN	**0.0001**	**1.659 (0.953–2.743)**

SDS, Self-Rating Depression Scale; CI, confidence interval; PN, positional nystagmus; DH, Dix–Hallpike positioning nystagmus; HN, head shaking after nystagmus.
Boldface type and underlined factors indicate statistical significance: $P < 0.1$ in the univariable analysis and $P < 0.05$ in the multivariable analysis.

(53/174) of those with unilateral Menière's disease, in 15.7% (11/70) of those with sudden deafness with vertigo, and in 12.5% (10/80) of those with vestibular neuritis (statistically: bilateral Menière's disease > unilateral Menière's disease > sudden deafness with vertigo = vestibular neuritis). As seen in Fig. 2, depression was diagnosed by SDS in 82.4% (42/51) of patients with bilateral Menière's disease, in 48.9% (85/174) of those with unilateral Menière's disease, in 38.6% (27/70) of those with sudden deafness with vertigo, and in 31.3% (25/80) of those with vestibular neuritis (statistically: bilateral Menière's disease > unilateral Menière's disease > sudden deafness with vertigo = vestibular neuritis).

Table 3
SDS logistical regression analysis of Menière's disease.

Parameter	*P*	Oz ratio (95% CI)
Univariable analysis		
Sex	0.184	1.132 (0.785–1.512)
Age	0.356	0.938 (0.665–1.226)
Disease duration	**0.036**	**1.252 (1.095–1.390)**
Vertigo frequency	0.666	0.890 (0.874–1.026)
PN/DH/HN	0.105	0.955 (0.804–1.100)
Initial hearing level	0.181	0.933 (0.858–1.031)
Secondary hearing level	**0.005**	**1.433 (1.010–1.875)**
Worse hearing level	0.508	0.825 (0.591–1.031)
Better hearing level	**0.003**	**1.350 (1.027–1.672)**
Multivariable analysis		
Disease duration	**0.021**	**1.212 (1.054–1.494)**
Secondary hearing level	**0.042**	**1.131 (1.016–1.187)**
Better hearing level	0.985	1.035 (1.017–1.054)

SDS, Self-Rating Depression Scale; CI, confidence interval; PN, positional nystagmus; DH, Dix–Hallpike positioning nystagmus; HN, head shaking after nystagmus.
Boldface type and underlined factors indicate statistical significance: $P < 0.1$ in the univariable analysis and $P < 0.05$ in the multivariable analysis.

Table 4
SDS logistical regression analysis of sudden deafness with vertigo.

Parameter	*P*	Oz ratio (95% CI)
Univariable analysis		
Sex	0.254	1.263 (0.835–1.562)
Age	0.433	0.985 (0.799–1.214)
Disease duration	**0.009**	**1.155 (1.035–1.251)**
Vertigo frequency	–	–
PN/DH/HN	**0.003**	**1.955 (1.254–2.737)**
Initial hearing level	0.185	1.225 (0.809–1.656)
Secondary hearing level	0.974	1.005 (0.868–1.130)
Worse hearing level	0.185	1.225 (0.809–1.656)
Better hearing level	0.974	1.005 (0.868–1.130)
Multivariable analysis		
Disease duration	0.331	1.180 (0.950–1.214)
PN/DH/HN	**0.005**	**1.895 (0.935–2.843)**
Initial hearing level = worse hearing level	0.185	1.295 (0.851–1.821)

SDS, Self-Rating Depression Scale; CI, confidence interval; PN, positional nystagmus; DH, Dix–Hallpike positioning nystagmus; HN, head shaking after nystagmus.
Boldface type and underlined factors indicate statistical significance: $P < 0.1$ in the univariable analysis and $P < 0.05$ in the multivariable analysis.

Using multivariable logistic regression analysis of the SDS results was similar to those attained with the CMI. All of the patients with persistent nystagmus in addition to their audiovestibular disease (Oz ratio 1.840; $P = 0.0001$) (Table 1), (Oz ratio 1.659; $P = 0.0001$) (Table 2); those with longer disease duration (Oz ratio 1.212; $P = 0.021$) and those with worse hearing level in the secondary affected ear (Oz ratio 1.131; $P = 0.042$) in the groups with Menière's disease (Table 3); those with persistent nystagmus (Oz ratio: 1.895; $P = 0.005$) in the group with sudden deafness with vertigo (Table 4); and those with longer disease duration (Oz ratio 1.422; $P = 0.019$) and persistent nystagmus (Oz ratio: 1.950; $P = 0.0003$) in the group with vestibular neuritis (Table 5) developed mental illness significantly more often than those with shorter disease duration, better hearing and no persistent nystagmus.

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Table 5
SDS logistical regression analysis of vestibular neuritis.

Parameter	*P*	Oz ratio (95% CI)
Univariable analysis		
Sex	0.952	0.668 (0.335–0.996)
Age	**0.013**	**1.585 (0.998–2.051)**
Disease duration	**0.005**	**2.122 (1.054–3.110)**
Vertigo frequency	–	–
PN/DH/HN	**0.0002**	**2.454 (1.798–3.268)**
Initial hearing level	0.534	0.750 (0.615–0.932)
Secondary hearing level	0.220	1.052 (1.029–1.075)
Worse hearing level	0.422	1.010 (0.955–1.110)
Better hearing level	0.220	1.045 (1.017–1.073)
Multivariable analysis		
Age	0.056	1.250 (0.688–2.046)
Disease duration	**0.019**	**1.422 (1.054–1.794)**
PN/DH/HN	**0.0003**	**1.950 (0.855–2.935)**

SDS, Self-Rating Depression Scale; CI, confidence interval; PN, positional nystagmus; DH, Dix–Hallpike positioning nystagmus; HN, head shaking after nystagmus.
Boldface type and underlined factors indicate statistical significance: $P < 0.1$ in the univariable analysis and $P < 0.05$ in the multivariable analysis.

4. Discussion

Neurosis and depression were diagnosed more frequently in patients with bilateral Menière's disease than in those with unilateral Menière's disease, sudden deafness with vertigo, or vestibular neuritis. For patients with audiovestibular diseases, the rates of neurosis and depression are increased in accordance with the presence of solo vertigo (vestibular neuritis: disease category 1), vertigo accompanied by unilateral hearing loss (sudden deafness with vertigo: disease category 2), unilateral repeated symptoms (unilateral Menière's disease: disease category 3), and repeated symptoms bilaterally (bilateral Menière's disease: disease category 4). These findings suggest that, when audiovestibular symptoms in patients with Menière's disease are repeated bilaterally for a prolonged time [13–15], psychological conditions in these patients worsen along with the progressive Menière's symptoms. Early appropriate intervention is important in these patients not only to maintain or improve the inner ear but also to avoid the development of mental illness [3–5].

Multivariable logistic regression analysis in SDS produced results similar to those attained by the CMI. That is, patients with persistent nystagmus, regardless of the particular audiovestibular disease, could suffer significant mental illness. Thus, it was not the frequency of vertigo but persistent nystagmus that hindered the daily lives of these patients with audiovestibular diseases, both physically and mentally. These findings indicate that we should make it a goal to suppress persistent motion-evoked dizziness as well as episodic rotatory vertigo attacks when treating patients with an audiovestibular disease [16,17]. According to the CMI in the present study, the disease category was significantly linked to the mental state in patients with audiovestibular disease. However, whether psychological characteristics may cause inner ear endolymphatic hydrops [18–20], or if the otopathology of Menière's disease affects psychological conditions [21] are questions that we plan to address in a prospective study in the near future.

We attempted here to identify prognostic factors that could negatively affect mental conditions in patients with each audiovestibular disease. In patients with Menière's disease, for instance, longer disease duration and a worse hearing level in the secondary affected ear gave rise to mental disorder. Thus, an initial or early appropriate intervention is essential to maintain or improve inner ear function in patients with Menière's disease [13–15]. Persistent nystagmus portended a negative prognosis regarding the mentality of patients who had sudden deafness with vertigo. In patients with vestibular neuritis, a longer duration of disease and persistent nystagmus had a negative effect. Generally, positional/positioning nystagmus after suffering from acute peripheral vestibular dysfunction is supposedly due mainly to secondary benign paroxysmal positional vertigo (BPPV) [22] and delayed dynamic vestibular compensation [23]. In the present study, persistent nystagmus in patients with Menière's disease was not a significant negative prognostic factor in regard to the mental state. Because symptoms in BPPV disappear immediately after free-moving otoliths disappear from the canal endolymph, the persistent nystagmus in patients with Menière's disease may be mainly caused by secondary BPPV. If dynamic vestibular compensation is not perfectly accomplished after static vestibular compensation, motion-induced dizziness plagues the patient's daily life for a long time. Similarly, as longer disease duration in patients with vestibular neuritis was also a negative prognostic factor for the mental state in our study, persistent nystagmus in these patients may be mainly caused by delayed dynamic vestibular compensation. The differences between patients who have sudden deafness with vertigo and those with vestibular neuritis may result from the different otopathology (i.e., different sites of peripheral vestibular lesions) [9,16].

According to the previous literatures, psychiatric diseases mostly associated with vestibular diseases are anxiety disorders, resulting in a use of minor tranquilizers but not anti-depressants for dizzy patients. But depression is also relevant psychiatric diseases associated with vestibular diseases as shown in the present study. We should take care of dizzy patients with mental illness by using appropriate kinds of medicine, minor tranquilizers and anti-depressants, in every situation [3,4].

Our study has some limitations. Several reliable questionnaires—e.g., Dizziness Handicap Inventory (DHI), Hospital Anxiety and Depression Scale (HADS), and Vertigo Symptom Scale (VSS)—are currently available for assessing the mental state of dizzy patients [3,4,24]. Furthermore, neurosis is now not an adequate diagnosis, but known as anxiety disorders. Our clinical study was performed prospectively from 1998, when we adopted the CMI and SDS for the psychological examinations. Another limitation in this study was that although hearing function was examined by audiometry, vestibular function and the endolymphatic hydrops level were not measured quantitatively, which may have some influence on the mental state [18–21]. Further additional studies are thus required.

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5. Conclusions

We established that mental disorder rates in patients with audiovestibular diseases increase in accordance with the presence of solo vertigo, vertigo accompanied by hearing loss, repeated symptoms, and bilateral hearing loss. Physicians should therefore consider various treatment strategies for patients who have persistent nystagmus, a history of prolonged disease duration, and/or hearing loss in the secondary affected ear to avoid development of a psychological disorder.

Conflicts of interest

None.

Financial disclosures

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