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Original Article

Questionnaires in Patients with Unilateral Sudden Sensorineural Hearing Loss

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OBJECTIVE: In this study, we evaluated the prognostic value of the Dizziness Handicap Inventory (DHI) and the Tinnitus Handicap Inventory (THI) in patients with unilateral sudden sensorineural hearing loss (SSNHL).

MATERIALS and METHODS: In total, 101 patients with unilateral SSNHL (44 women, 57 men), who were admitted and treated at our institution between December 2012 and June 2014, were included in the study. All patients completed the questionnaires for DHI and THI during their admission and were treated with bed rest and oral methylprednisolone (1 mg/kg, which was eventually tapered). Of these, 83 patients received intratympanic dexamethasone 4 times over a 2-week period. Demographic data, accompanying symptoms, and DHI and THI subscales were compared between the non-recovery group (Siegel's criteria type 4, n=63) and the recovery group (Siegel's criteria type 1–3, n=38).

RESULTS: There were no significant differences between the two groups with regard to gender, hypertension, diabetes mellitus, cerebrovascular attack, and tinnitus. Patients in the non-recovery group were significantly older (51.53 vs. 50.24 years, $p<0.05$) and had a higher incidence of chronic kidney disease (10.53% vs. 1.59%, $p<0.05$) than those in the recovery group. Although more patients in the non-recovery group complained of dizziness (47.37% vs. 25.40%, $p<0.05$), DHI subscales were not significantly different between the groups. THI subscales were also not significantly different between the two groups.

CONCLUSION: DHI and THI questionnaires may have limited prognostic value for patients with unilateral SSNHL.

KEYWORDS: Questionnaires, sudden sensorineural hearing loss, dizziness, tinnitus

INTRODUCTION

Sudden sensorineural hearing loss (SSNHL) is defined as an increase in hearing threshold of more than 30 dB over three consecutive frequencies within 72 hours. This is regarded as an otological emergency and requires immediate treatment. However, recovery rates are poor and hard to predict. The identification of prognostic factors may help the development of more efficient therapeutic strategies.

Dizziness and tinnitus are common symptoms associated with SSNHL. Although dizziness is a well-accepted factor predicting poor prognosis of the disease [1], the relationship between the severity of dizziness and expected outcomes requires further evaluation. However, the importance of tinnitus as a factor predicting poor prognosis of SSNHL remains controversial [2].

Questionnaires are useful tools for quantifying symptoms associated with SSNHL. They are also economic, convenient, non-invasive, and timesaving diagnostic modalities. Nevertheless, few studies have investigated the prognostic value of questionnaires for patients with SSNHL. The Dizziness Handicap Inventory (DHI) is useful for evaluating the extent of symptoms observed in patients with vertigo [3]. The responsiveness (sensitivity to change) of DHI is superior to other self-reported measures commonly used for patients who complain of dizziness [4]. DHI also significantly correlates with the sensory organizing test and can be used to evaluate compensation after vestibular neuritis [5]. The Tinnitus Handicap Inventory (THI) is a commonly used diagnostic tool for evaluating the severity of tinnitus. The significant correlation of THI with the visual analog scale (VAS) is well accepted [6, 7]. THI may also be a useful screening test to evaluate sleep disorders and hyperacusis in patients who complain of tinnitus [8]. Evaluation of the prognostic values of DHI and THI in patients with unilateral SSNHL may be very significant in the clinical field.

Presented in: This study was presented in 20th combined congress of Korean Otorhinolaryngology - Head and Neck Surgery (10/October, 2014, Daejeon, Republic of Korea).

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The purpose of the present study was to evaluate the prognostic values of questionnaires in patients with unilateral SSNHL and to identify clinical features of the non-recovery group after medical treatment/intervention.

MATERIALS and METHODS

Study Population

Medical records of 101 patients treated in the Department of Otorhinolaryngology -Head and Neck Surgery at Korea University Ansan Hospital between December 2012 and June 2014 were reviewed retrospectively. These included 57 males (56.4%) and 44 females (43.6%). Age at diagnosis ranged from 18 to 82 years. The mean age was 52.98 years.

Patients included in the study showed the following characteristics: (1) complained of unilateral acute hearing loss within 72 hours; (2) had been objectively diagnosed with SSNHL according to initial pure tone audiometry (PTA) (an increase of more than 30 dB in the hearing threshold over three consecutive frequencies); (3) complained of dizziness and/or ipsilateral tinnitus as accompanying symptoms; (4) answered questionnaires (DHI and/or THI) at the first visit; and (5) were followed up with PTA 3 months after treatment.

The following patients were excluded from the study: those who (1) complained of bilateral acute hearing loss; (2) did not complain of dizziness or ipsilateral tinnitus as an accompanying symptom; (3) refused to answer the questionnaires; (4) had a history of trauma in the ipsilateral temporal area; (5) had abnormal physical findings in the ipsilateral ear (otitis media, otitis externa, or perforation of the tympanic membrane); (6) had a retrolabyrinthine lesion detected by radiological evaluation (vestibular schwannoma, etc.); (7) had a genetic or craniofacial syndrome; or (8) refused follow-up PTA. This study was reviewed and approved by the institutional review board (IRB) of Korea University Ansan Hospital (No. of IRB: AS15038).

Physical Examination and Retrospective Chart Review

At the first visit, patients' external auditory canal and tympanic membrane were evaluated under rigid endoscopy. To detect retrolabyrinthine lesions, subjects who complained of dizziness underwent auditory brainstem response measurement, video nystagmography, smooth pursuit test, optokinetic nystagmus, and optokinetic after-nystagmus tests at the Hearing and Balance Center of Korea University Ansan Hospital. Magnetic resonance imaging of the internal auditory canal was conducted for abnormal findings that led to the suspicion of a retrolabyrinthine lesion.

The following additional variables were obtained by retrospective chart review for analysis: gender, age, hypertension, diabetes mellitus (DM), cerebrovascular attack (CVA) history, and chronic kidney disease (CKD).

Audiological Evaluation and Determination of Therapeutic Effect

All subjects were admitted and treated with bed rest. A 12-day course of oral methylprednisolone was administered (1 mg/kg for 4 days, which was eventually tapered). The mean hospital stay was 6.60 days. Of the total, 83 patients received intratympanic dexamethasone (IT-dexa) 4 times over 2 weeks as initial treatment, excluding those who rejected treatment.

All subjects underwent PTA testing during their admission and 3 months after treatment at the audiology and vestibulogy laboratory of our hospital. Hearing thresholds were recorded using air conduction at frequencies of 125, 250, 500, 1000, 2000, 3000, 4000, 6000, and 8000 Hz. Mean hearing thresholds were expressed as the average of hearing thresholds at 500, 1000, 2000, and 4000 Hz (6-tone average). Replacing the hearing thresholds at frequencies of 500, 1000, 2000, and 4000 Hz by a, b, c, and d, respectively, the average of hearing thresholds was calculated as (a + 2b + 2c + d)/6.

The average of hearing thresholds during admission and 3 months after treatments were paired and compared for all patients. Siegel's criteria were used to evaluate hearing improvements and to divide patients into non-recovery group (Siegel's criteria type 4) or recovery group (Siegel's criteria type 1–3) [9].

Questionnaires

At the first visit, all patients answered the Korean version of the DHI and/or the THI based on their accompanying symptoms. DHI is a 25-item questionnaire composed of functional (0–36), emotional (0–36) and physical domains (0–28) [3]. Patients were asked to answer each item with "yes" (4 points), "sometimes" (2 points) or "no" (0 points). After the completion of the questionnaire, DHI grades were stratified according to the total DHI score: slight (0–14), mild (16–34), moderate (36–52), and severe (54–100).

THI is also a 25-item self-response questionnaire with three possible answers: "yes" (4 points), "no" (0 points), or "sometimes" (2 points) [6, 7]. THI grades were determined according to the total THI score: slight (0–16), mild (18–36), moderate (38–56), severe (58–76), or catastrophic (78–100). Subscales of the THI were also estimated: functional (0–44), emotional (0–36), and catastrophic scales (0–20).

Statistical Analysis

Statistical analyses were performed using SPSS 20.0 version (IBM Corp.;, Armonk, New York, USA). Independent *t*-test was used to compare continuous variables such as age, total score, and subscales of DHI and THI. Pearson's chi-square test and Fisher's exact test were used to compare nominal data such as gender, DM, hypertension and CVA history and to compare grades of DHI and THI between the non-recovery group and the recovery group. All continuous variables are expressed as mean ± standard deviation.

Statistically significant variables were evaluated using multivariate logistic regression. Odds ratios with 95% confidence intervals were reported. All results were considered significant with $p<0.05$.

RESULTS

In total, 38 patients were included in the non-recovery group, and the remaining 63 patients were included in the recovery group. The recovery rate was 62.38% (Figure 1).

Patients in the non-recovery group were significantly older than those in the recovery group (mean ages; 57.53 vs. 50.24 years, respectively, $p<0.05$, Table 1). There were no statistically significant differences in hypertension or DM between the two groups. In contrast, there was a higher percentage of CKD in the non-recovery group than in the recovery group (10.53% vs. 1.59%, respectively, $p<0.05$).

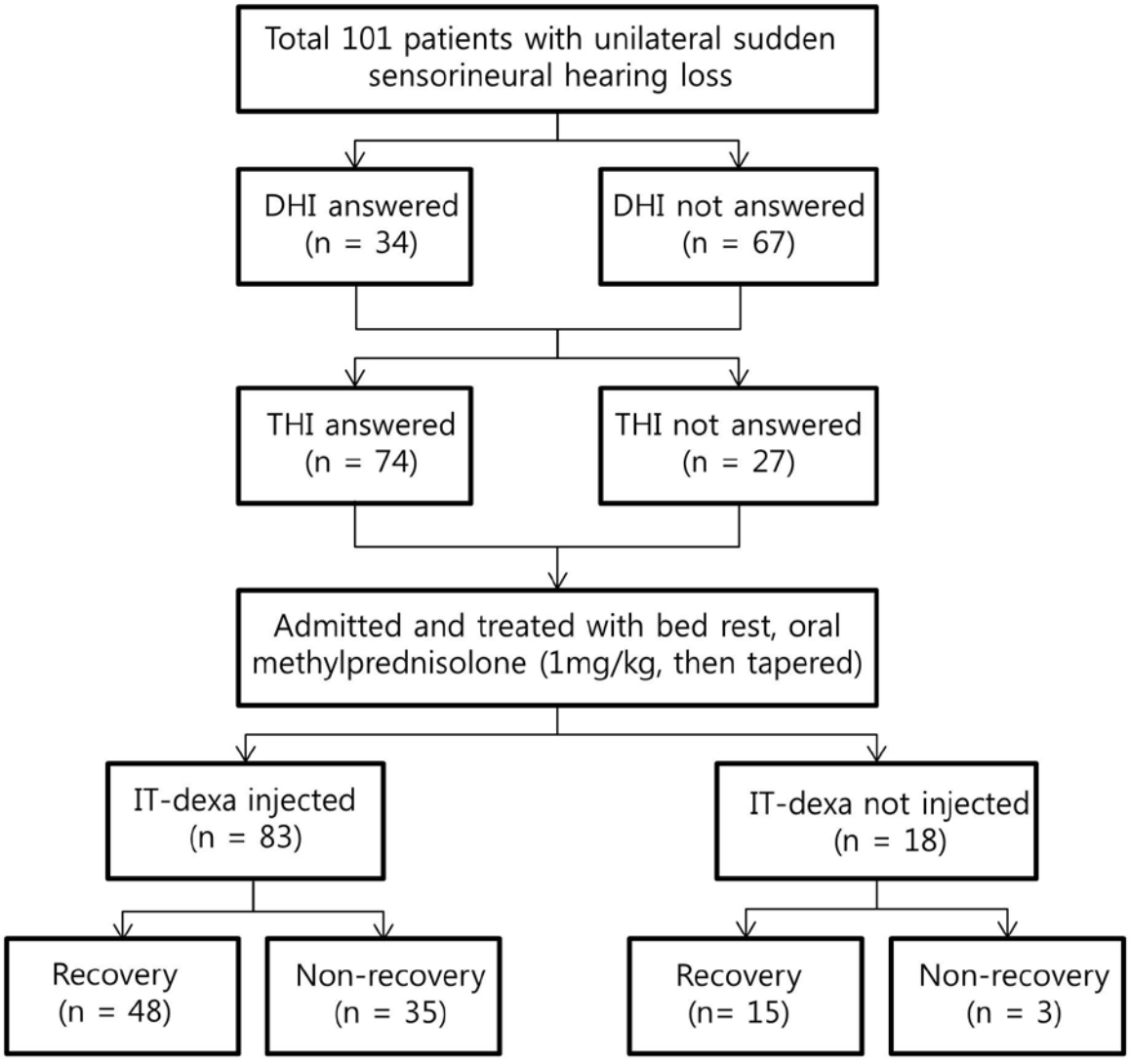

Figure 1. Treatment course and subjective outcomes in 101 patients with unilateral sudden sensorineural hearing loss.
DHI: dizziness handicap inventory; THI: tinnitus handicap inventory; IT-dexa: intratympanic dexamethasone

Table 1. Comparison of demographic data and symptoms

	Non-recovery group (n=38)	Recovery group (n=63)	p
Number	38	63	
Gender (n, %)			0.29
Male	24 (63.16%)	33 (52.38%)	
Female	14 (36.84%)	30 (47.62%)	
Age (years)	57.53±12.45	50.24±11.83	0.00*
Hypertension (n, %)	15 (39.47%)	15 (23.81%)	0.10
DM (n, %)	14 (36.84%)	17 (26.98%)	0.30
CVA (n, %)	3 (7.90%)	3 (4.76%)	0.52
CKD (n, %)	4 (10.53%)	1 (1.59%)	0.05*
Dizziness (n, %)	18 (47.37%)	16 (25.40%)	0.02*
Tinnitus (n, %)	26 (68.42%)	48 (76.19%)	0.39

Values presented as mean±SD for continuous variables.
DM: diabetes mellitus; CVA: cerebrovascular attack; CKD: chronic kidney disease
*p<0.05

Although more patients in the non-recovery group complained of dizziness (47.37% vs. 25.40%, respectively, p<0.05, Table 1) than those in the recovery group, there was no statistically significant difference in the components of DHI between two groups (Table 2). There was also no statistically significant difference in the percentage of ipsilateral tinnitus (Table 1), or in comparison of scores or grades of THI (Table 2) between the two groups.

IT-dexa was conducted in 83 patients, of which 48 patients were included in the recovery group. The recovery rate in patients who received IT-dexa was 57.83% (p=0.04).

Statistically significant variables (age, CKD, dizziness, and IT-dexa) were analyzed with multivariate logistic regression to identify variables that could determine non-recovery after treatment. Age was categorized into two groups (<50 and ≥50 years) and the results were analyzed. The final model suggests that IT-dexa [odds ratio (OR), 0.245; 95% confidence interval (CI): 0.061–0.985, p<0.05, Table 3] may be a predictor of non-recovery after treatment. The OR for the treatment response to IT-dexa for treatment failure was 0.245, suggesting

Table 2. Comparison of the components of DHI and THI

	Non-recovery group (n=38)	Recovery group (n=63)	p
DHI total score	35.86±25.35	22.93±18.33	0.13
Functional scale	13.29±9.75	8.40±7.68	0.14
Emotional scale	11.86±8.39	7.33±7.24	0.13
Physical scale	10.71±8.47	7.20±5.23	0.19
DHI grade			0.59
Slight (Grade 1)	4 (28.57%)	7 (46.67%)	
Mild (Grade 2)	4 (28.57 %)	5 (33.33%)	
Moderate (Grade 3)	2 (14.29%)	1 (6.67%)	
Severe (Grade 4)	4 (28.57%)	2 (13.33%)	
THI total score	35.30±24.71	39.22±24.75	0.54
Functional scale	15.74±11.67	18.04±10.85	0.42
Emotional scale	14.17±10.68	14.61±9.91	0.87
Catastrophic scale	5.39±4.37	6.57±5.26	0.36
THI grade			0.64
Slight (Grade 1)	7 (30.43%)	10 (21.74%)	
Mild (Grade 2)	7 (30.43%)	15 (32.61 %)	
Moderate (Grade 3)	3 (13.04%)	11 (23.91%)	
Severe (Grade 4)	5 (21.74 %)	6 (13.04%)	
Catastrophic (Grade 5)	1 (4.35%)	4 (8.70%)	

Values presented as mean±SD for continuous variables.
DHI: dizziness handicap index; THI: tinnitus handicap index
* p<0.05

Table 3. Multivariate logistic regression model for Treatment failure

	Odds ratio (95% confidence interval)	p
Age (years)		
<50	-	-
≥50	2.190 (0.852–5.633)	0.104
CKD	12.551 (0.996–158.244)	0.050
IT-dexa	0.245 (0.061–0.985)	0.048*
Dizziness	2.299 (0.929–5.688)	0.072

CKD: chronic kidney disease; IT-dexa: intratympanic dexamethasone injection
* p<0.05

that the probability of recovery in patients who received IT-dexa may about four times (4.082=1/0.245) higher than in patients who did not receive IT-dexa.

DISCUSSION

The chief issue raised by the present study is whether SSNHL has a relationship with tinnitus and dizziness. Although discussed for over 30 years, the relationship between SSHL and tinnitus is controversial. In our analysis, retrospective analysis of variables from demographic data, accompanying symptoms, questionnaires, and treatment options provides insights in to factors that may predict treatment failure in patients with unilateral SSNHL. Recovery rate was 62.38% in the present study. To identify reasons for the difference in recovery rate compared to other studies, the heterogeneity of steroid treatment options may be considered. Despite various studies on steroid therapy for SSNHL, a standard treatment for SSNHL has not yet been agreed upon. In a review of steroid therapy for SSNHL, OR of 1.52 (95% CI: 0.83–2.77) was observed in the steroid versus placebo analysis [10]. A systemic versus intratympanic steroid analysis resulted in OR of 1.14 (95% CI: 0.82–1.59) [10]. In the salvage treatment analysis, OR was 6.04 (95% CI: 3.26–11.2) [10]. Clinical practice guidelines for SSNHL also recommend intratympanic steroid injection following the failure of initial treatment [11]. In a study by Belhassen and Saliba [12], IT-dexa was an effective salvage treatment in patients with SSNHL who did not recover following an initial oral steroid regimen.

Despite previous studies recommending intratympanic steroid injection as a salvage option, in the present study, IT-dexa was administered as the initial combined treatment to maximize the therapeutic effect. The final logistic regression model suggests that IT-dexa may be a predictor of recovery after treatment in case of patients with SSNHL. Gundogan et al. [13] also reported that combined therapy is more effective than oral steroid monotherapy in hearing outcome of patients with severe hearing loss. Additionally, Gunel et al. [14] reported that 87.5% of patients who were initially treated with an intratympanic steroid showed full recovery (Siegel's criteria type 1). In contrast, all patients who receive intratympanic steroid as a salvage treatment did not recover (Siegel's criteria type 4) [14]. Conversely, some studies report contradictory results of initial intratympanic steroid injection. In a review stating the use of intratympanic steroids for initial treatment, Labatut et al. [15] reported that recovery rates ranged widely, from 45% to 86%. Park et al. [16] also reported that initial IT-dexa did not result in additional hearing gain compared with IT-dexa as a salvage therapy. In the present study, recovery rates (Siegel's criteria type 1–3) were 80.68% (71/88). With regard to results from other studies, the recommendation of IT-dexa as initial therapy in all cases remains controversial, despite the results from the present study. In addition, although some controversy has existed concerning the effectiveness of IT-dexa as a salvage therapy, limitations of this study included that IT-dexa could not be added as a salvage therapy in oral steroid group. Further studies in this direction are necessary.

In this study, Korean versions of DHI and THI were completed by patients and analyzed. In a study for the standardization of the Korean adaptation of self-reported measures evaluating dizziness, Han et al. [17] found that DHI has significant internal consistency and validity. In a study to evaluate the reliability and validity of the Korean version of THI, Kim et al. [18] found THI and its subscales to have valuable internal consistency, test-retest reliability, and convergence and construct validity.

It is reported that DHI outcomes strongly correlate with computerized dynamic posturography and electronystagmography and moderately correlate with rotation chair tests and sensory organization tests [19]. It is also reported that DHI outcomes moderately correlate with VAS results for vertigo [19]. In this study, although more patients in the non-recovery group complained of dizziness than in the recovery group, subscales of DHI were not significantly different between the two groups. However, it is important to consider that only 34 patients complained of dizziness and completed the DHI questionnaire. Dizziness has been reported as a negative prognostic factor in many studies [20]. Considering the clinical value of DHI, further studies with larger number of patients may be required.

In a study of a tinnitus scoring questionnaire in patients with SSNHL, Hikita-Watanabe et al. [21] reported that the "tinnitus-often" group had a better prognosis than the "tinnitus-rare" group, and the "shorter duration" group had a better prognosis than the "longer duration" group. From these results, they interpreted that tinnitus itself may not be a poor prognostic factor for hearing recovery but may be important for the repair of a damaged auditory system. Rah et al. [22] reported that successful treatment of SSNHL may be an important factor in obtaining favorable long-term control of tinnitus accompanied by SSNHL. In this study, there were no significant differences in tinnitus, total THI, and THI subscales between the non-recovery and recovery groups. This may be due to the small sample size. Further studies with more subjects may yield different results.

In addition, different questionnaires that evaluate tinnitus may show different distribution and characteristics of patients.

Ryu et al. [23] reported that hyperglycemia may be a negative prognostic factor in SSNHL. In this study, there was no statistically significant difference in the incidence of DM between the non-recovery and recovery groups. In a systematic review and meta-analysis of the risk factors for SSNHL, a positive correlation was identified between cardiovascular risk factors and SSNHL [20]. Lin et al. [24] reported that genetic mutations related to increased risk of thromboembolic events are risk factors for SSNHL. In this study, there was no statistical significance between hearing recovery and vascular abnormalities (hypertension and CVA). Nevertheless, diagnosis and treatment of uncontrolled vascular disease is important because it may complicate the recovery of patients with SSNHL.

In addition, the percentage of patients with CKD was significantly higher in the non-recovery group than in the recovery group. Many studies have reported that CKD may cause malfunction of the auditory and vestibular systems [25]. Although the causes of SSNHL are still unclear, the auditory nerve is regarded as a primary site for pathogenesis. Further research to find a correlation between SSNHL and cochlear abnormality may also be significant.

An important strength of the present study is the inclusion of follow-up PTA in all patients. As a result, improvements in hearing were defined by objective hearing results. Additionally, retrolabyrinthine lesions were excluded by two methods. Radiological evaluations were conducted only in patients with suspicious results from audiological and vestibulogical tests. As a result, unnecessary radiological evaluations were avoided. Finally, to the authors' knowledge, the present study is the first study to evaluate the prognostic effects of DHI and THI at the subscale level. Hence, considering the clinical advantages of the questionnaire, this study may be very significant. However, further studies with larger number of patients are required.

In conclusion, the use of questionnaires for patients with unilateral SSNHL has a limited prognostic value. Further research with larger number of patients may be required to substantiate the results from the present study. Other questionnaires that evaluate tinnitus and dizziness may provide additional insights for prognostic factors of SSNHL. IT-dexa may be an effective initial treatment alongside an oral steroid regimen. Additional studies of treatment strategies using systemic and intratympanic steroids are necessary.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Korea University Ansan Hospital.

Informed Consent: This study was a retrospective study and was exempted from informed consent.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - G.H.H., J.C.; Design - G.H.H., J.C.; Supervision - Y.C.R., J.C.; Resources - G.H.H., J.C. ; Materials - Y.C.R., J.C.; Data Collection and/or Processing - G.H.H., J.W.J., I.S.S.; Analysis and/or Interpretation - G.H.H., Y.C.R., J.C. ; Literature Search - G.H.H., J.W.J., I.S.S.; Writing Manuscript - G.H.H., J.C.; Critical Review - J.C.

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REFERENCES

1. Kuhn M, Heman-Ackah SE, Shaikh JA, Roehm PC. Sudden sensorineural hearing loss: a review of diagnosis, treatment, and prognosis. Trends Amplif 2011; 15: 91-105. [CrossRef]
2. Nosrati-Zarenoe R, Arlinger S, Hultcrantz E. Idiopathic sudden sensorineural hearing loss: results drawn from the Swedish national database. Acta Otolaryngol 2007; 127: 1168-75. [CrossRef]
3. Jacobson GP, Newman CW. The development of the Dizziness Handicap Inventory. Arch Otolaryngol Head Neck Surg 1990; 116: 424-7. [CrossRef]
4. Friscia LA, Morgan MT, Sparto PJ, Furman JM, Whitney SL. Responsiveness of self-report measures in individuals with vertigo, dizziness, and unsteadiness. Otol Neurotol 2014; 35: 884-8. [CrossRef]
5. Lim HW, Kim KM, Jun HJ, Chang J, Jung HH, Chae SW. Correlating the head shake-sensory organizing test with dizziness handicap inventory in compensation after vestibular neuritis. Otol Neurotol 2012; 33: 211-4. [CrossRef]
6. Figueiredo RR, Azevedo AA, Oliveira Pde M. Correlation analysis of the visual-analogue scale and the Tinnitus Handicap Inventory in tinnitus patients. Braz J Otorhinolaryngol 2009; 75: 76-9. [CrossRef]
7. Newman CW, Jacobson GP, Spitzer JB. Development of the Tinnitus Handicap Inventory. Arch Otolaryngol Head Neck Surg 1996; 122: 143-8. [CrossRef]
8. Fioretti AB, Fusetti M, Eibenstein A. Association between sleep disorders, hyperacusis and tinnitus: evaluation with tinnitus questionnaires. Noise Health 2013; 15: 91-5. [CrossRef]
9. Siegel LG. The treatment of idiopathic sudden sensorineural hearing loss. Otolaryngol Clin North Am 1975; 8: 467-73.
10. Crane RA, Camilon M, Nguyen S, Meyer TA. Steroids for treatment of sudden sensorineural hearing loss: a meta-analysis of randomized controlled trials. Laryngoscope 2015; 125: 209-17. [CrossRef]
11. Stachler RJ, Chandrasekhar SS, Archer SM, Rosenfeld RM, Schwartz SR, Barrs DM, et al. Clinical practice guideline: sudden hearing loss. Otolaryngol Head Neck Surg 2012; 146: S1-35. [CrossRef]
12. Belhassen S, Saliba I. Intratympanic steroid injection as a salvage treatment for sudden sensorineural hearing loss. J Laryngol Otol 2014: 1-6. [CrossRef]
13. Gundogan O, Pinar E, Imre A, Ozturkcan S, Cokmez O, Yigiter AC. Therapeutic efficacy of the combination of intratympanic methylprednisolone and oral steroid for idiopathic sudden deafness. Otolaryngol Head Neck Surg 2013; 149: 753-8. [CrossRef]
14. Gunel C, Basal Y, Toka A, Eryilmaz A, Kurt Omurlu I. Efficacy of low-dose intratympanic dexamethasone for sudden hearing loss. Auris Nasus Larynx 2015; 42: 284-7. [CrossRef]
15. Labatut T, Daza MJ, Alonso A. Intratympanic steroids as primary initial treatment of idiopathic sudden sensorineural hearing loss. The Hospital Universitario Ramon y Cajal experience and review of the literature. Eur Arch Otorhinolaryngol 2013; 270: 2823-32. [CrossRef]

16. Park MK, Lee CK, Park KH, Lee JD, Lee CG, Lee BD. Simultaneous versus subsequent intratympanic dexamethasone for idiopathic sudden sensorineural hearing loss. Otolaryngol Head Neck Surg 2011; 145: 1016-21. [CrossRef]
17. Han GC, Lee EJ, JH L. The study of standardization for a Korean adaptation of self-report measures of dizziness. Res Vestibul Sci 2004; 3: 307-25.
18. Kim JH, Lee SY, CH K. Reliability and validity of a Korean adaptation of the tinnitus handicap inventory. . Korean J Otolaryngol 2002; 45: 328-34.
19. Mutlu B, Serbetcioglu B. Discussion of the dizziness handicap inventory. J Vestib Res 2013; 23: 271-7.
20. Enache R, Sarafoleanu C. Prognostic factors in sudden hearing loss. J Med Life 2008; 1: 343-7.
21. Hikita-Watanabe N, Kitahara T, Horii A, Kawashima T, Doi K, Okumura S. Tinnitus as a prognostic factor of sudden deafness. Acta Otolaryngol 2010; 130: 79-83. [CrossRef]
22. Rah YC, Park KT, Yi YJ, Seok J, Kang SI, Kim YH. Successful treatment of sudden sensorineural hearing loss assures improvement of accompanying tinnitus. Laryngoscope 2015; 125: 1433-7. [CrossRef]
23. Ryu OH, Choi MG, Park CH, Kim DK, Lee JS, Lee JH. Hyperglycemia as a potential prognostic factor of idiopathic sudden sensorineural hearing loss. Otolaryngol Head Neck Surg 2014;1 50: 853-8. [CrossRef]
24. Lin RJ, Krall R, Westerberg BD, Chadha NK, Chau JK. Systematic review and meta-analysis of the risk factors for sudden sensorineural hearing loss in adults. Laryngoscope 2012; 122: 624-35. [CrossRef]
25. Vilayur E, Gopinath B, Harris DC, Burlutsky G, McMahon CM, Mitchell P. The association between reduced GFR and hearing loss: a cross-sectional population-based study. Am J Kidney Dis 2010; 56: 661-9. [CrossRef]