



Original Article

Recovery of Idiopathic Sudden Sensorineural Hearing Loss

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OBJECTIVE: The objective was to identify and evaluate factors that may influence the recovery rate in patients with idiopathic sudden sensorineural hearing loss (ISSNHL).

MATERIALS and METHODS: A retrospective analysis was performed for patients with sudden sensorineural hearing loss between 2009 and 2013. Those with an identified etiology were excluded. The patients were divided into four treatment groups: (i) systemic corticosteroids (SC) only, (ii) SC+low-molecular-weight heparin (LMWH), (iii) SC+hyperbaric oxygen (HBO), and (iv) SC+LMWH+HBO. Recovery was evaluated according to Siegel's criteria. Age, initial hearing level, onset, treatment and audiogram types, comorbidities, and associated tinnitus and vestibular symptoms were investigated for their impact on prognosis.

RESULTS: Two hundred five patients with ISSNHL were included. Recovery was seen in 59% of the patients. The complete recovery rate was significantly lower in patients older than 60 years and in patients presenting with profound hearing loss. Different audiogram curves had no significant effect on recovery. Sudden hearing loss was accompanied by tinnitus in 107 (52.1%) patients and vestibular symptoms in 55 (26.8%); however, neither was noted to affect prognosis. Different treatment combinations did not significantly affect prognosis. However, hypertension and a delay in treatment by more than 10 days from the onset of hearing loss were associated with a worse prognosis.

CONCLUSION: Profound hearing loss, older than 60 years, a delay in treatment by more than 10 days, and hypertension were negative prognostic factors in this study, whereas, the type of audiogram curve and addition of HBO to SC did not affect prognosis.

KEYWORDS: Idiopathic sudden sensorineural hearing loss, prognosis, systemic corticosteroids, hyperbaric oxygen, heparin

INTRODUCTION

Sudden sensorineural hearing loss (SSNHL) is defined as 30 dB or more of sensorineural hearing loss over at least three consecutive frequencies within 3 days^[1-5]. In total, 85%–90% of cases are idiopathic at presentation^[6]. Viral infections, vascular compromise, autoimmunity, and intralabyrinthine membrane rupture are considered as the main potential causes of idiopathic SSNHL (ISSNHL)^[1,7-9]. The degree of hearing loss, time period from the onset of hearing loss and beginning of treatment, audiometric configuration, comorbidities (hypertension, diabetes), and presence of vestibular symptoms and tinnitus may influence the course of ISSNHL^[7,10,11].

Treatment protocols for ISSNHL aim to decrease the inflammatory state of the inner ear and to increase the blood supply and oxygenation^[1,12]. Steroids, vasodilators, plasma expanders, and antiviral and diuretic agents are preferred for these purposes in different combinations^[10]. Low-molecular-weight heparin (LMWH) and hyperbaric oxygen (HBO) therapies have also been reported to have some treatment advantages^[12,13].

The present study aimed to identify epidemiological data, types of audiogram, efficacy of different treatment modalities, and the recovery rate in patients with idiopathic SSNHL.

MATERIALS and METHODS

A retrospective chart review was performed for patients with a diagnosis of SSNHL between 2008 and 2013. Those patients with an identified cause were excluded, and only idiopathic cases were investigated. Bilateral cases were also not included due to a very low proportion of patients (9 patients) relative to the total cohort. The study was approved by the local ethics committee (575 – Jan 9th, 2015).

The age, gender, affected side, routine blood tests including complete blood count and basic biochemical parameters, time period from the onset of hearing loss and the beginning of treatment, treatment modalities, associated symptoms (vestibular and auditory),

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and comorbidities were recorded. Cranial and temporal bone magnetic resonance imaging (MRI) was performed for all patients. Those with a lesion known to be associated with SSNHL on imaging (vestibular schwannoma or inner ear malformation) were excluded. The patients were grouped according to their ages as those aged less than 20 years, those between 20 and 40, those between 40 and 60, and those more than 60. Patients younger than 15 years were excluded.

Audiometric investigation: Pure-tone and speech audiometry were performed for all patients (AC 40; Interacoustics, Middelfart, Denmark). In pure-tone audiometry, hearing thresholds at 250, 500, 1000, 2000, 4000, and 8000 Hz frequencies were obtained. The pure-tone average (PTA) was determined by calculating the arithmetic mean of the 500, 1000, 2000, and 4000 Hz thresholds. Audiograms were classified as upsloping, downsloping, or flat, according to the hearing thresholds at different frequencies. An upsloping curve was defined as a more severe (>20 dB) hearing loss at low (250 and 500 Hz) frequencies, whereas a downsloping curve was defined as a more severe (>20 dB) hearing loss at high (4000 and 8000 Hz) frequencies. An audiometric curve with no more than 15 dB difference at any frequency was accepted as being flat. The audiometric variables at the time of admission before treatment and 6 months after the end of treatment were recorded. The hearing gain for each frequency and PTA were calculated by taking the difference between the pre- and post-treatment thresholds. In accordance with the American Speech and Hearing Association guidelines, hearing loss was defined as mild (20–39 dB HL), moderate (40–54 dB HL), moderate to severe (55–69 dB HL), severe (70–89 dB HL), and profound (>90 dB HL).

Treatment: Systemic corticosteroids (SC; methylprednisolone 1 mg/kg po (per oral) and tapering gradually) were used for all patients. The patients were classified into four treatment groups: (i) those given SC (Prednol; Mustafa Nevzat, İstanbul, Turkey) only, (ii) those given SC and HBO, (iii) those given SC and LMWH (Fraxiparine, Glaxo Smith Kline, Canada), and (iv) those given SC, HBO, and LMWH. HBO was given for a total of 20 sessions at 2.5 ATA and 120 min per session. In LMWH treatment, fraxiparine was given as a single dose (0.3 mL) for 7 days.

Recovery: Siegel's criteria were used for the assessment of recovery. Complete recovery was defined as a final hearing better than 25 dB. Partial recovery was defined as a hearing gain of more than 15 dB and a final hearing between 25 dB and 45 dB. A hearing gain of more than 15 dB and a final hearing poorer than 45 dB was accepted as a slight improvement, and a hearing gain of less than 15 dB and a final hearing poorer than 75 dB was considered as showing no improvement.

The prognostic factors investigated were age, initial level of hearing, type of audiogram curve, time period between the onset of hearing loss and treatment, treatment protocols, comorbidities (hypertension and diabetes), and presence of tinnitus and vestibular symptoms.

Statistical Analysis

SPSS version 15.0 was utilized for statistical analysis (IBM Corporation, USA). One-way ANOVA and Kruskal–Wallis tests were used for comparing numerical variables. For subgroup analyses, Tukey and Mann–Whitney U tests were chosen for parametric and nonparametric evaluations, respectively. Chi-square test was used for categorical variables. A p-value of less than 0.05 was considered to be statistically significant.

Table 1. Recovery rates according to Siegel's criteria

Recovery	Patient number (%)
Complete recovery	58 (28.3%)
Partial recovery	22 (10.7%)
Slight improvement	41 (20%)
No improvement	84 (41%)

Table 2. Recovery rates of ears with SSNHL in different age intervals

Recovery	No improvement	Slight improvement	Partial recovery	Complete recovery
Age groups				
Mean age	48.0±16.4	47.3±17.8	44.0±13.0	41.3±12.6
<20	4 (36.4%)	3 (27.3%)	0 (0.0%)	4 (36.4%)
21–40	25 (35.2%)	13 (18.3%)	11 (15.5%)	22 (31.0%)
41–60	36 (40.4%)	15 (16.9%)	8 (9.0%)	30 (33.7%)
>60	19 (55.9%)	10 (29.4%)	3 (8.8%)	2 (5.9%)*

SSNHL: sudden sensorineural hearing loss, *p=0.046

Table 3. Effect of initial hearing loss on recovery rates

Recovery	No improvement	Slight improvement	Partial recovery	Complete recovery
Initial hearing loss				
Mild	11 (55%)	0 (0%)	0 (0%)	9 (45%)
Moderate	12 (36.4%)	0 (0%)	5 (15.2%)	16 (48.5%)
Moderate to severe	14 (36.8%)	3 (7.9%)	6 (15.8%)	15 (39.5%)
Severe	19 (35.8%)	11 (20.8%)	9 (17%)	14 (26.4%)
Profound	28 (45.9%)	27 (44.3%)	2 (3.3%)	4 (6.6%)

RESULTS

Two hundred five (114 males, 91 females) patients with ISSNHL were included. The mean age of the patients was 45.9±15.4 (range: 15–98). Hearing loss was right-sided in 112 (54.6%) patients and left-sided in 93 (45.4%).

The recovery rates according to Siegel's criteria are given in Table 1. Gender had no statistically significant effect on recovery (p=0.539). No significant age difference was noted between the recovery groups (p=0.065).

Eleven patients (5.3%) were under 20 years, whereas 71 (34.6%) were between 21 and 40, 89 (43.4%) were between 41 and 60, and 34 (16.5%) were more than 60 years. The age interval most commonly affected was between 41 and 60. The complete recovery rate was significantly lower in patients older than 60 years (2 patients, 3.4% of all complete recoveries) (p=0.046). The recovery rates in the four age intervals are shown in Table 2.

The initial audiometric evaluations revealed that 20 patients (9.8%) had mild hearing loss, whereas 33 (16.1%) had moderate, 38 (18.5%) had moderate to severe, 53 (25.9%) had severe, and 61 (29.8%) had profound hearing loss. The higher the initial hearing thresholds, the higher the rate of no improvement following treatment (Table 3). The complete recovery rate was significantly lower in patients with profound hearing loss (p<0.001).

Table 4. Effects of comorbidities and associated symptoms on recovery rates

		n, %	No improvement	Slight improvement	Partial recovery	Complete recovery
DM	Absent	169 (82%)	69 (40.8%)	31 (18.3%)	18 (10.7%)	51 (30.2%)
	Present	37 (18%)	15 (41.7%)	10 (27.8%)	4 (11.1%)	7 (19.4%)
HT	Absent	160 (78.1%)	59 (36.9%)	35 (21.9%)	15 (9.4%)	51 (31.9%)*
	Present	45 (21.9%)	25 (55.6%)	6 (13.3%)	7 (15.6%)	7 (15.6%)*
Tinnitus	Absent	98 (47.9%)	47 (48.0%)	18 (18.4%)	10 (10.2%)	23 (23.5%)
	Present	107 (52.1%)	37 (34.6%)	23 (21.5%)	12 (11.2%)	35 (32.7%)
Vestibular symptoms	Absent	150 (73.2%)	60 (40.0)	28 (18.7%)	16 (10.7%)	46 (30.7%)
	Present	55 (26.8%)	24 (43.6%)	13 (23.6 %)	6 (10.9%)	12 (21.8%)

DM: diabetes mellitus; HT: hypertension; *p=0.032

Table 5. Recovery rates in treatment groups

	No improvement	Slight improvement	Partial recovery	Complete recovery
SC	16 (33.3%)	10 (20.8%)	7 (14.5%)	15 (31.2%)
SC+LMWH	11 (40.7%)	2 (7.4%)	4 (14.8%)	10 (37%)
SC+HBO	24 (45.2%)	16 (30.1%)	4 (7.5%)	9 (16.9%)
SC+LMWH+HBO	33 (42.9%)	13 (16.9%)	7 (9.1%)	24 (31.2%)

SC: systemic corticosteroids; LMWH: low-molecular-weight heparin; HBO: hyperbaric oxygen

An upsloping audiogram curve was noted in 32 (15.6%) patients, whereas a downsloping curve was noted in 42 (20.4%) patients and a flat audiogram was noted in 131 (63.9%). The type of audiogram curve had no significant effect on recovery (p=0.099).

Tinnitus was present in 107 (52.1%) patients and vestibular symptoms in 55 (26.8%) (Table 4). Neither tinnitus nor vestibular symptoms were noted to have a significant effect on recovery (p=0.253, p=0.627, respectively). The presence of these symptoms did not correlate with the type of audiogram curve or with the severity of the initial hearing loss (p>0.05).

The coexistence of systemic diseases and their association with recovery are shown in Table 4. The rate of hypertension was significantly lower in the complete recovery group (p=0.032).

With regard to treatment, 48 patients received SC only, 27 received SC and LMWH, 53 received SC and HBO, and 77 received SC, LMWH, and HBO (Table 5). The recovery types in the treatment groups were also not significantly different (p=0.259). When the time period between the onset of hearing loss and the beginning of treatment was more than 10 days, the rate of no recovery was significantly higher (p=0.010).

DISCUSSION

Many factors have been reported to have a prognostic impact on ISSNHL. Unfortunately, no consensus has been achieved on these factors. Different treatment protocols and recovery definitions may be responsible for the lack of consensus.

The spontaneous recovery rate of ISSNHL ranges between 32% and 65% and most commonly occurs within the first two weeks after the onset of hearing loss [6, 14]. The recovery rate (including slight, partial,

and complete) in our series was 59% (121 patients). In other studies where Siegel criteria were utilized for the recovery definitions, the overall recovery rate was reported as 35% (by Psifidis) and 67.8% (by Lee) [1, 15]. Actually, to define recovery is a matter of debate in reporting and comparing the results of ISSNHL cases. Criteria may include the absolute decibel (dB) gain or relative dB gain (percentage of improvement), or may use the contralateral ear as a reference [3]. We prefer to use Siegel criteria because they include both the hearing gain and the residual hearing status of the patient.

ISSNHL occurs across a wide range of ages; however, it is more common between 30 and 50 years of age [15, 16]. In our series, most of the cases were between 41 and 60 years of age. More importantly, older age (>60 years) was shown to have a negative prognostic impact with 55.9% of the cases in this age group having no recovery (p=0.046). Although some previous reports have shown that older age is related to negative prognosis [17], others have found no correlation between age and prognosis [16, 18, 19]. By contrast, younger patients were reported to have a better prognosis by some authors [20].

The type of the audiogram curve has also been investigated as a prognostic factor in many previous studies [16, 20, 21]. Downward sloping (greater hearing loss at high frequencies) has been reported as a negative prognostic factor, whereas upward sloping (low frequency hearing loss) has been related to a better prognosis [17, 20, 21]. In our series, the audiometric configuration was not correlated with recovery.

The correlation between the degree of initial hearing loss and recovery has been well established [1, 2, 16, 22, 23]. In the present study, patients presenting profound hearing loss had the highest rate of no recovery (45.9%) compared with a complete recovery rate of 6.6%.

The coexistence of vestibular symptoms has been considered as a negative prognostic factor in many previous studies [1, 2, 16, 19, 20, 22, 24]. The involvement of the superior vestibular pathway and extensive damage of the inner ear may be responsible for the appearance of vertigo in ISSNHL [2, 24]. In our study, 55 patients (26.8%) had accompanying vestibular symptoms, but no significant correlation to prognosis was noted. This result was also supported by some previous reports [15, 17, 23, 25, 26].

One hundred seven patients in this study (52.1%) presented with tinnitus along with hearing loss. The hearing outcomes of patients with or without tinnitus did not significantly differ (p=0.253). This finding is in

accordance with some previous studies [16, 20, 25, 26]. Tinnitus seems to be only an accompanying symptom in our study, without influencing the prognosis. On the other hand, tinnitus has been reported as a prognostic factor correlated with better recovery rates in some studies [19, 27].

The impact of the presence of comorbidities (hypertension and diabetes mellitus) on the outcome is not well known. These systemic diseases have been considered as poor prognostic factors in some studies [28], whereas they were shown to be unrelated to the outcome in some other studies [16, 29]. In our study, the only notable correlation was found between hypertension and prognosis, where we found that patients with hypertension have a higher ratio of non-recovery compared to those without hypertension ($p=0.032$).

The treatment of ISSNHL remains the most challenging subject. Because the etiology is unclear, many treatment options are utilized with different protocols [14]. SC continue to be widely used despite the presence of some recent papers questioning their efficacy [6, 21, 30, 31]. Additional treatment modalities, including HBO, antivirals, and vasodilators, have also been extensively studied with conflicting results [14, 32-35]. In our series, we found no additional benefit of HBO and/or LMWH when used in combination with SC ($p=0.15$), in contrast to some other reports mentioning their advantages [12, 13, 32].

The time between the onset of hearing loss and of treatment appears to be an important prognostic factor in this study. The effects of the causative factor may become permanent with time [6, 16]. In our series, beginning treatment 10 days after the onset of hearing loss is related to a worse prognosis. A delayed onset of treatment is reported to be a negative prognostic factor in many previous reports [16, 20, 21-23].

Age, the degree of initial hearing loss, the time period between the onset of hearing loss and treatment, and hypertension have all been shown to affect the prognosis of sudden hearing loss in our series. Similarly, the addition of HBO and/or anticoagulation with heparin yields no treatment advantage over the use of SC alone.

Ethics Committee Approval: The study was approved by the Local Ethics Committee of İstanbul Training and Research Hospital, 575 – 9th Jan 2015.

Informed Consent: Written informed consent was not obtained due to the retrospective nature of this study.

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