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ORIGINAL ARTICLE

Analysis of Prognostic Factors in Sudden Idiopatic Sensorineural Hearing Loss

Ani İdiyopatik Sensörinöral İşitme Kaybında Prognostik Faktörlerin Analizi

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ABSTRACT

Objective: Sudden idiopathic sensorineural hearing loss (SISHL) is defined as an audiological emergency and although many studies have been conducted on the factors affecting prognosis, there is no consensus yet. The aim of this study is to analyze the prognostic value of clinical and audiological factors in patients with SISHL.
Patients and Method: The data of 210 patients, 118 male and 92 female, who were treated for SISHL, were analyzed retrospectively. Demographic data, audiometry findings, additional symptoms and diseases of the patients were recorded. Degree of hearing loss; were classified as mild (26-40 dB), moderate (41-55 dB), moderately-severe (56-70 dB), severe (71-90 dB) and profound (> 90 dB) according to pure tone audiometry test. The type of hearing loss was determined as descending type, ascending type, midfrequency type and flat type. The patients were divided into three groups as those who started treatment in the first 3 days, between 3-10 days and after 10 days. The effects of age, gender, audiometric findings, additional symptoms and diseases on pre-treatment hearing level, post-treatment hearing level and hearing gain levels were evaluated.
Results: The median age of the patients was 46.0 (18.0) years. The most common flat audiogram (54.8 %) was seen in the patients. It was observed that patients with flat type audiograms had more hearing loss and less hearing gain. It was determined that hearing gain was higher in patients with severe hearing loss ($p < 0.05$). There was no significant difference in the pre-treatment and post-treatment hearing levels (p; 0.051 and 0.409, respectively) according to the treatment initiation time, but there was a significant difference in the hearing gain levels ($p = 0.005$). In patients who started treatment in the first 3 days, the gain was higher than those who started after 4-10 days and 10 days. It was observed that there was no significant difference in pre-treatment and post-treatment hearing levels and hearing gain levels according to gender, affected ear direction, additional findings and presence of diseases.
Conclusion: Early initiation of treatment was found to be the most important prognostic factor in SISHL. Raising public awareness for early diagnosis and treatment will reduce the sequelae that may occur due to SISHL.

Keywords: Sudden sensorineural hearing loss, Prognostic factor, ENT emergencies.

ÖZ

Amaç: Ani idiyopatik sensörinöral işitme kaybı (AİSNİK) odyolojik acil bir durum olarak tanımlanır. AİSNİK'te prognozu etkileyen faktörlerle ilgili pek çok çalışma yapılmış olmasına rağmen henüz fikir birliği yoktur. Bu çalışmanın amacı AİSNİK olan hastalarda klinik ve odyolojik faktörlerin prognostik değerinin analiz edilmesidir.
Hastalar ve Yöntem: AİSNİK nedeniyle tedavi edilen 118'i erkek, 92'si kadın 210 hastanın verileri retrospektif olarak incelendi. Hastaların demografik verileri, odyometri bulguları, ek semptom ve hastalıkları kaydedildi. İşitme kaybının derecesi; saf ses odyometri testine göre hafif (26-40 dB), orta (41-55 dB), orta-şiddetli (56-70 dB), şiddetli (71-90 dB) ve derin (> 90 dB) olarak sınıflandırıldı. İşitme kaybının şekli saf ses odyometri testine göre inen tip, çıkan tip, çanak tip ve düz tip olarak belirlendi. Hastaların tedaviye başlama zamanına göre ilk 3 günde, 3-10 gün arası ve 10 günden sonra olacak şekilde üç gruba ayrıldı. Yaş, cinsiyet, odyometrik bulgular, ek semptom ve hastalıkların; tedavi öncesi ve tedavi sonrası işitme seviyesi ile işitme kazanç seviyesi üzerine etkileri değerlendirildi.
Bulgular: Hastaların yaşlarının medyan değeri 46.0 (18.0) yıl idi. Odyometrini tipine göre en sık düz tip odyogram (%54.8) olduğu görüldü. Düz tip odyogramlara sahip hastalarda işitme kaybı seviyesi daha yüksek iken işitme kazançlarının daha az olduğu tespit edildi. Şiddetli işitme kaybı olan hastalarda işitme kazancının daha fazla olduğu belirlendi ($p < 0.05$). Tedaviye başlama sürelerine göre tedavi öncesi ve tedavi sonrası işitme seviyelerinde anlamlı fark yoktu (sırasıyla p; 0.051 ve 0.409) ancak işitme kazanç seviyelerinde anlamlı fark olduğu tespit edildi ($p = 0.005$). İlk 3 günde tedaviye başlanan hastalarda işitme kazanç seviyesi 4-10 gün ve 10 günden sonra başlananlara göre daha fazla idi. Hastalarda cinsiyet, etkilenen kulak yönü, ek bulgu ve hastalıkların varlığına göre tedavi öncesi ve tedavi sonrası işitme seviyeleri ile işitme kazanç seviyelerinde anlamlı fark olmadığı görüldü.
Sonuç: Tedaviye erken başlamanın AİSNİK'te en önemli prognostik faktör olduğu görüldü. İşitme kayıplarında erken tanı ve tedavi için toplumun bilinçlendirilmesi AİSNİK nedeni ile oluşmuş sekelleri azaltacaktır.

Anahtar kelimeler: Ani sensorinöral işitme kaybı, Prognostik faktör, KBB acilleri

Introduction

Sudden hearing loss is sensorineural hearing loss that develops within a maximum of 72 hours and causes hearing loss of 30 dB or more in at least three frequencies. Sudden hearing loss affects 5-20/100.000 people per year and often occurs unilaterally (1). It is generally seen equally in both sexes and is more common in people between the ages of 30 and 60 (2). Causes are attributed to infectious diseases, vascular disorders and autoimmune diseases, but in most cases the etiology has not been exactly determined. Sudden hearing loss is considered when the cause of hearing loss cannot be determined exactly. In the treatment of patients with SISHL; methods such as having a rest, salt-free diet, corticosteroids, drugs to improve blood circulation, vasodilators, antiviral drugs, diuretics, and hyperbaric oxygen therapy are used (3–6). Multiple treatment modalities have been used together to suppress inflammation and autoimmune damage, reduce edema, and regulate cochlear perfusion. (7). On the other hand, it has been reported that 47% to 63% of patients who were not treated spontaneously recovered within 2 weeks (5,8).

In patients with sudden idiopathic hearing loss, the time to start treatment, severity of hearing loss, type of hearing loss, and presence of additional diseases are factors that are considered to affect the prognosis (5,7,9). However, since many studies have reported different results, there is no consensus on the factors affecting the prognosis of SISHL. In this study, we aimed to investigate the prognostic effects of demographic and audiological findings in patients who received a standard treatment protocol.

Patients and Method

The data of the patients who were treated in Konya City Hospital Otorhinolaryngology clinic due to SISHL between January 1, 2016 and October 1, 2020 were analyzed retrospectively. The age, gender, onset of hearing loss, time of admission to the hospital, and whether there was any comorbid disease were recorded. In patients treated with systemic methylprednisolone (1mg/kg, dose gradually tapering off over 14 days), intratympanic dexamethasone (5 doses, 0.5 ml) and hyperbaric oxygen therapy (5 days a week, 1 hour a day for a total of 20 sessions at 2 ATA pressures) files were examined. Ethics committee approval was obtained before the study (Date: 04.12.2020, number: 2020 / 2933).

Those with bilateral hearing loss, those under the age of 18 and over the age of 65, those with intracranial pathology on contrast magnetic resonance imaging, those with middle ear infection in the last 10 days, those with hearing loss due to other reasons such as Meniere's disease, otosclerosis, congenital deafness, presbycusis, Patients with trauma, neurologic comorbidities, ototoxic drug use history and inadequate medical records were excluded from the study. After applying the exclusion criteria, the remaining 210 patients, 118 male and 92 female, out of a total of 324 patients whose records were reviewed, were included in the study.

Pure tone audiometry (Interacustic AC 40, Assens, Denmark) was used to evaluate the hearing of all patients. Air and bone conduction were evaluated at frequencies of 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz and 8 kHz. Pure tone mean was calculated by averaging the air conduction thresholds at 4 frequencies at 500, 1000, 2000 and 4000 Hz (10). According to pure tone audiometry test results, hearing levels were recorded before and after treatment at 1 month. Hearing gain level was calculated by taking the difference of pure tone audiometry values before and after treatment. The degree of hearing loss was classified as mild (26-40 dB), moderate (41-55 dB), moderately severe (56-70 dB), severe (71-90 dB), and profound (> 90-dB) (6). Four different groups were formed according to the audiogram type. These groups are; descending type (hearing loss at high frequencies), ascending type (with low frequency hearing loss), midfrequency type (hearing loss at medium frequencies is more severe), and flat type (maximum deviation of 15 dB in the frequency range from 250 to 8000 Hz) (11). In addition, the patients were grouped as 0-3 days, 4-10 days, 10 days or more, according to the time of initiation of treatment. Hearing levels and hearing gains of patients before and after treatment; Age, gender, affected ear direction, degree of hearing loss, type of hearing loss, time of initiation of treatment, additional symptoms and diseases were compared.

Statistical method: Descriptive statistics were used to compare the general characteristics of all participants. Test of Normality, including Kolmogorov-Smirnov and Shapiro-Wilk tests, was used to determine the distribution of data. Data that did not have a normal distribution were given as the median (interquartile range). Categorical variables were expressed as numbers (n) and percentages (%). Comparison of numerical data between groups was made with the appropriate one from Mann-Whitney U test and Kruskal-Wallis test. Spearman correlation analysis was used to evaluate the relationships. Variables contributing to hearing level were evaluated with multiple linear regression. Statistical Package for Social Sciences (SPSS) Windows software (ver. 22; IBM SPSS, Chicago, USA) was used for all statistical analyses. P value below 0.05 was considered statistically significant.

Results

The median age of the patients included in the study was 46.0 (18.0) years [median 44 (18) years in men and 50 (20) years in women]. The right ear was affected in 100 (47.6 %) patients, and the left ear was affected in 110 (52.4 %) patients. Tinnitus was found in 157 (74.8 %) patients, vertigo in 59 (28.1 %) patients, Diabetes Mellitus (DM) in 53 (25.2 %) patients and hypertension in 17 (8.1 %) patients. According to the audiogram patterns of the patients, 39 (18.6 %) had descending type, 43 (20.5 %) ascending type, 13 (6.2 %) midfrequency type and

115 (54.8 %) flat type hearing loss. Hearing loss was mild in 44 (21.0 %) patients, moderate in 54 (25.7 %) patients, moderatly-severe in 49 (23.3 %) patients, severe in 24 (11.4 %) patients, and profound in 39 (18.6 %) patients. It was determined that after the onset of hearing loss, treatment was started in the first 3 days in 68 (29.5 %) patients, between 4-10 days in 101 (48.1 %) patients and after 10 days in 41 (19.5 %) patients. The median hearing level of the patients before the treatment was 57.0 (36) dB, the median hearing level after the treatment was 33.0 (39.0) dB, and the median hearing gain was 20.0 (29.0) dB. (Table 1)

Table 1: Demographic and clinical characteristics of the patients

(n = 210)	Number of patients (%)
Gender	
Male	118 (56.2)
Female	92 (43.8)
Affected ear	
Right	100 (47.6)
Left	110 (52.4)
Degree of hearing loss	
Mild (26-40 dB)	44 (21.0)
Moderate (41-55 dB)	54 (25.7)
Moderately severe (56-70 dB)	49 (23.3)
Severe (71-90 dB)	24 (11.4)
Profound (≥ 90 dB)	39 (18.6)
Type of hearing loss	
Descending	39 (18.6)
Ascending	43 (20.5)
Midfrequency	13 (6.2)
Flat	115 (54.8)
Treatment initiation time	
0-3 days	68 (29.5)
4-10 days	101 (48.1)
>10 days	41 (19.5)
Additional symptom, comorbidities	
Tinnitus	157 (74.8)
Vertigo	59 (28.1)
DM	53 (25.2)
HT	17 (8.1)
	Median (Interquartile range).
Age	46.0(18.0)
Hearing level before treatment	57.0 (36.0)
Hearing level after treatment	33.0 (39.0)
Hearing gain level	20.0 (29.0)

Abbreviations: DM; Diabetes Mellitus, HT; Hypertension

It was observed that there was no significant difference in the pre-treatment, post-treatment and hearing gain levels of the patients according to gender (p values; 0.916, 0.738 and 0.979, respectively). In the evaluation made according to the type of hearing loss, it was determined that there was a significant difference in the hearing levels before and after the treatment, but there was no significant difference between the hearing gain levels (p values <0.001, <0.001 and 0.507, respectively). It was observed that patients with flat type audiograms had more hearing loss, while hearing gains were less. In the evaluation made according to the degree of hearing loss, it was determined that there was a significant difference between the levels of hearing gain (p<0.001). The gain was greater in patients with severe hearing loss. There was no significant difference in the pre-treatment and post-treatment hearing levels according to the initiation time of treatment (p; 0.051 and 0.409, respectively). However, it was determined that there was a significant difference in hearing gain levels according to the treatment initiation time (p = 0.005). Patients who started treatment in the first 3 days had greater gains than those started after 4-10 days and 10 days [26.5 (36) dB, 18.0 (30) dB, and 13.0 (21) dB, after respectively]. It was observed that the presence of additional findings and systemic disease did not have a significant effect on pre-treatment and post-treatment hearing levels and hearing gain levels. (Table 2)

A linear stepwise regression model was created to determine the prognostic factors contributing to the improvement of hearing levels. This statistically significant model (r = 0.342, p < 0.05) explained 10.9 % of the total variance. It was found that the hearing level before the treatment and the time of initiating the treatment contributed significantly to the hearing gain level. Hearing gain levels, the time to start treatment had a negative effect, and the hearing level before treatment had a positive effect. (Table 3)

Discussion

SISHL is mostly seen in patients between the ages of 30 and 60, and advanced age is considered as a poor prognostic factor (1,5,12,13). The success rate in the treatment of hearing loss may decrease due to the physiological changes that occur with aging (12). Many studies report that the prognosis is significantly better in patients under the age of 60 (12,14). Childhood is considered to be a poor prognostic factor (1,6). In addition to studies reporting a better recovery rate in younger patients, there are studies reporting that there is no relationship between age and SISHL prognosis (15–19). In our study, it was determined that the age of the patients did not have a significant effect on hearing loss levels and hearing gain levels.

It is known that SISHL affects both genders equally (5). However, some authors suggest that being female is a negative prognostic factor, while others report that there is no difference between genders (5,12,20-22). In our study, there was no significant difference in terms of the rate of impact of women and men, hearing levels before and after treatment, and hearing gain level. In SISHL, the affected ear is usually unilateral. It has been reported that less than 1.7 % of the patients are

Table 2: Analysis findings of pre-treatment, post-treatment and hearing gain levels in patients

			Hearing level before treatment (dB)		Hearing level after treatment (dB)		Hearing gain Level (dB)	
		N	Median (Iqr)	p	Median (Iqr)	p	Median (Iqr)	p
Gender								
Male		118	57.0 (35)	0.916[µ]	35.0 (42)	0.738[µ]	21.0 (27)	0.979[µ]
Female		92	58.0 (35)		32.0 (37)		18.0 (32)	
Affected Ear								
Right		100	56.0 (32)	0.359[µ]	31.5 (33)	0.444[µ]	19.0 (31)	0.675[µ]
Left		110	63.0 (37)		36.0 (44)		20.0 (26)	
Type of hearing loss								
Descending		39	50.0 (24)	**<0.001**[Δ]	30.0 (22)	**<0.001**[Δ]	21.0 (24)	0.507[Δ]
Ascending		43	43.0 (20)		21.0 (26)		22.0 (28)	
Midfrequency		13	50.0 (34)		38.0 (43)		26.0 (23)	
Flat		115	65.0 (43)		45.0 (45)		17.0 (30)	
Degree of hearing loss								
Mild (26-40 dB)		44	35.0 (8)	**<0.001**[Δ]	22.0 (19)	**<0.001**[Δ]	11.5 (17)	**<0.001**[Δ]
Moderate (41-55 dB)		54	48. 0 (9)		28.0 (24)		18.0 (21)	
Moderately severe (56-70 dB)		49	63.0 (9)		37.0 (36)		27.0 (37)	
Severe (71-90 dB)		24	78.0 (8)		37.0 (43)		40.5 (43)	
Profound (<90 dB)		39	100.0 (0)		75.0 (43)		22.0 (38)	
Treatment initiation time								
0-3 days		68	65.0 (34)	0.051[Δ]	32.0 (41)	0.409[Δ]	26.5 (36)	**0.005**[Δ]
4-10 days		101	57.5 (41)		34.0 (43)		18.0 (30)	
over 10 days		41	53.0 (29)		33.0 (34)		13.0 (21)	
Additional symptom, comorbidities								
Tinnitus	Yes	157	57.0 (33)	0.512[µ]	31.0 (39)	0.120[µ]	21.0 (31)	0.422[µ]
	No	53	63.0 (52)		37.0 (44)		17.0 (27)	
Vertigo	Yes	59	63.0 (47)	0.071[µ]	40.0 (50)	0.231[µ]	17.0 (33)	0.791[µ]
	No	141	55.0 (33)		32.0 (36)		21.0 (28)	
DM	Yes	53	60.0 (26)	0.421[µ]	35.0 (42)	0.961[µ]	20.0 (47)	0.951[µ]
	No	157	57.0 (36)		33.0 (39)		20.0 (27)	
HT	Yes	17	58.0 (40)	0.827[µ]	40.0 (31)	0.197[µ]	18.0 (18)	0.538[µ]
	No	193	57.0 (36)		33.0 (39)		20.0 (31)	

Abbreviations: N; Number of patients, Iqr; Interquartile range, dB; desibell, [µ]Mann-Whitney U test, [Δ]Kruskal-Wallis test, DM; Diabetes Mellitus, HT; Hypertension

Table 3: Multiple linear regression analysis of prognostic factors in patients.

Variable	**Hearing gain level model, r = 0.342**		
	Coefficient	Standard Error	p
Constant	14.743	7.35	**0.046**
Treatment initiation time	-6.041	2.014	**0.003**
Hearing level before treatment	0.252	0.064	**<0.001**
Age	-0.084	0.115	0.469
Gender	-2.495	2.929	0.395
Tinnitus	4.167	3.245	0.201
Vertigo	-2.573	3.225	0.426

bilateral (23). Patients with unilateral hearing loss were included in our study. It was observed that both ears were affected equally and there was no significant difference in terms of hearing gain level.

There are publications reporting poor treatment success rates in patients with severe hearing loss at baseline (7,12,24). There are also studies reporting that patients with hearing loss of 90 dB and above will not recover regardless of the treatment given (20). Lee et al. (24) reported an improvement of 42.9 % in patients with severe hearing loss at baseline and 83.0 % in patients with moderate hearing loss. Kaplan et al. (9) reported in their study that as the severity of hearing have loss increases, the success achieved with treatment decreases, and therefore the severity of hearing loss is an important prognostic factor. Bulgurcu et al. (19), determined complete recovery in 55 % of the patients with a loss of more than 70dB and partial recovery in 58% of them. The authors interpreted this situation as the earlier admission of patients with severe hearing loss to the hospital. In our study, it was determined that there was a significant difference between the degree of hearing loss and the level of hearing gain, and that the hearing gain was higher in those with severe hearing loss (71-90 dB).

Different results have been reported regarding the treatment outcome according to the audiometric form of the hearing loss. Byl et al. (1) stated that the midfrequency type audiogram had a poor prognosis in 225 disease studies. Ceylan et al. (20), on the other hand, found that the hearing gain was higher in patients with a midfrequency type audiogram. Zadeh et al. (25) also reported that the response to treatment was better in patients with ascending type audiogram. Kaplan et al. (9) reported that flat type (53.6 %) hearing loss was the most common type of hearing loss in patients, and that there was no significant relationship between the type of hearing loss and recovery. In our study, flat type audiogram (54.8 %) was seen most frequently in patients. It was determined that while patients with flat type audiogram had more hearing loss, their hearing gain was less. It was determined that there was a significant difference in hearing levels before and after treatment according to the type of hearing loss, but there was no significant difference between hearing gain levels.

It is suggested that early initiation of treatment is an important prognostic factor in SISHL (7). Moskowitz et al. (18) reported a recovery rate of 68 % in patients admitted within 3 days, 56 % in patients admitted within 7 days, and 28 % in patients admitted after 7 days. Similarly, Cho et al. (26) found significantly higher recovery rates (88 %) in patients treated within the first 3 days. Huy and Sauvage (27) are of the opinion that if the treatment is started within the first week, there is no difference in the result of the treatment between the 1st and 6th days of the treatment, and the delay in starting the treatment does not affect the final degree of hearing loss. In our study, it was observed that there was a significant difference in the hearing gain levels of the patients according to the time of initiation of the treatment. It was determined that those who started treatment in the first three days had higher gains than those who started after 4-10 days and 10 days. Although there are different opinions in the literature about the association of tinnitus with SISHL, there is a consensus about the positive prognostic effect of tinnitus in general (11,18,28). Kasapoglu et al. (17) reported that 82.6 % of patients with SISHL had accompanying tinnitus, but there was no statistically significant difference in recovery between patients with and without tinnitus. In our study, tinnitus was observed in 74.8 % of the patients. However, there was no significant difference in pre-treatment hearing, post-treatment hearing level and hearing gain levels between patients with and without tinnitus.

Vertigo is thought to be a poor prognostic factor for patients with SISHL and has been reported to accompany 40-60 % of patients (1,12,18,20,29). In the study of Kaplan et al. (9), it was observed that the success of treatment was lower in patients with vertigo complaints compared to those without vertigo. Fetterman et al. (23) reported that vertigo had no effect on hearing recovery in patients with SISHL. In our study, 28.1 % of the patients had vertigo complaints. There was no significant difference between patients with and without vertigo in pre-treatment hearing level, post-treatment hearing level and hearing gain levels.

It is thought that systemic diseases such as hyperlipidemia, diabetes and hypertension will adversely affect the severity of hearing loss and recovery rates by causing circulatory disorders in small vessels (13,30). Ohinata et al. (31) stated that diabetes adversely affected the prognosis of SISHL. Ceylan et al. (20) also reported that systemic diseases did not affect the prognosis of SISHL. In our study, 25.2 % of the patients had diabetes and 8.1 % had hypertension. However, there was no significant difference in pre-treatment hearing level, post-treatment hearing level and hearing gain level between patients with and without diabetes and hypertension.

The limitations of our study are that it is a retrospective study, it is a single-center study, and the number of prognostic factors investigated is low. In addition, since our hospital is a third-level hospital, all treatment options including hyperbaric oxygen therapy were applied, so patients who were applied a single treatment protocol were included in the study.

Conclusion

Having a flat-type audiogram was a negative prognostic factor in SISHL. Early initiation of treatment was found as the most important positive prognostic factor. Raising public awareness for early diagnosis and treatment in hearing loss will reduce the sequelae caused by SISHL.

Conflict of Interest: There is no conflict of interest in the study.

Financial Conflict of Interest: There is no financial conflict of interest in the study.

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