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Retrospective evaluation of the relationship between seasonal factors and idiopathic sudden sensorineural hearing loss

Kasım Durmuş[1], Adem Bora[1], Selim Çam[2,3], Emine Elif Altuntaş[1]

[1]*Department of Otolaryngology, Faculty of Medicine, Cumhuriyet University, Sivas, Turkey*
[2]*Department of Production Management, Faculty of Business, Gaziosmanpaşa University, Tokat*
[3]*Statistician, Cumhuriyet University Hospital, Sivas, Turkey*

Abstract

Objective: We aimed to investigate whether climatic conditions of the region where we live and meteorological parameters had any effect on pathogenesis and prognosis of idiopathic sudden sensorineural hearing loss (ISSNHL) or not.

Methods: Sixty-eight ISSHL patients, who were treated in our department, were evaluated retrospectively. Meteorological data, including monthly ambient, maximum and minimum temperatures, relative humidity, atmospheric pressure and rainfall, were obtained from the observation station of the Central Weather Bureau of Sivas. The meteorological data for 10 days before the onset of the disorder and in a period of 21 days after the beginning of the treatment were used to investigate the relationship between climatic data and ISSNHL. Siegel's criteria were used to evaluate the treatment success.

Results: The relationship between ISSNHL and seasons was observed to be statistically significant when the seasonal distributions of the cases were evaluated statistically ($p<0.05$; $p=0.008$). The change between Siegel's criteria and season was also statistically significant ($p<0.001$). As recovery in hearing of cases with ISSNHL in accordance with Seigel's criteria and meteorological parameters were evaluated, a statistically significant difference was determined in terms of weather temperature; minimum pressure, and rainfall in the period of 10 days before the treatment. However, when patients were evaluated based on meteorological variables in the period of 21 days after the treatment, there was a statistical correlation with the hearing recovery of the patients according to Siegel's criteria only in terms of rainfall ($p<0.005$).

Conclusion: Our study is the first one indicating that there might be a relationship between rainfall and both pathogenesis and prognosis of ISSNHL. Even though the results of the related studies in the literature varied, we concluded that the relationship between ISSNHL and temperature, pressure, rainfall, and season should not be ignored.

Keywords: Sudden sensorineural hearing loss, season, weather conditions, etiology, recovery.

Özet: İklim şartları ile idiyopatik ani sensörinöral işitme kaybı arasındaki ilişkinin retrospektif değerlendirmesi

Amaç: Kendi yaşadığımız bölgenin iklim şartları ve meteorolojik parametrelerin idiyopatik ani sensörinöral işitme kaybının (ISSNHL) patogenezi ve prognozu üzerinde bir etkisinin olup olmadığını araştırmayı amaçladık.

Yöntem: Bölümümüzde tedavileri yapılmış olan 68 ISSNHL tanısı olan hasta retrospektif olarak incelendi. Aylık ortam sıcaklığı, maksimum ve minimum sıcaklık, bağıl nem, atmosfer basıncı ve yağış miktarını içeren meteorolojik veriler, Sivas Meteoroloji Müdürlüğü gözlem istasyonundan elde edildi. İklimsel veriler ile ISSNHL arasındaki ilişkileri araştırmak için hastalığın başlamasından 10 gün önceki ve tedaviye başlanmasından itibaren 21 günlük bir periyottaki meteorolojik veri değerleri kullanıldı. Tedavi başarısının değerlendirilmesinde ise Siegel kriterleri kullanıldı.

Bulgular: Olguların mevsimlere göre dağılımları istatistiksel açıdan değerlendirildiğinde ISSNHL ile mevsimler arasındaki ilişkinin istatistiksel açıdan anlamlı olduğu izlendi ($p<0.05$; $p=0.008$). Siegel kriterleri ile mevsim arasındaki değişim de istatistiksel açıdan anlamlı idi ($p<0.001$). ISSNHL'li olguların Siegel kriterlerine göre işitmelerindeki düzelme ile meteorolojik parametreler değerlendirildiğinde, tedavi öncesi 10 günlük dönemde minimum, maksimum, ortalama hava sıcaklığı; minimum basınç ve yağışla istatistiksel olarak anlamlı bir farklılık olduğu tespit edildi. Bununla birlikte, tedavi sonrası 21 günlük periyottaki meteorolojik değişkenlerden sadece yağış miktarı ile Siegel kriterlerine göre hastaların işitmelerindeki düzelme arasında istatistiksel açıdan bir korelasyon söz konusu idi ($p<0.005$).

Sonuç: Çalışmamız yağış miktarı ile ISSNHL'nin hem patogenezi hem de prognozu arasında bir ilişki olabileceğini işaret eden ilk çalışmadır. Literatürde yer alan bu konuda yapılmış çalışmaların sonuçları farklılıklar göstermekle birlikte ISSNHL ile sıcaklık, basınç, yağış ve mevsim arasındaki ilişkinin de göz ardı edilmemesi gerektiği kanısındayız.

Anahtar sözcükler: Ani sensörinöral işitme kaybı, mevsim, hava koşulları, etyoloji, iyileşme.

Correspondence: Kasım Durmuş, MD. Department of Otolaryngology, Faculty of Medicine, Cumhuriyet University, Sivas, Turkey.
e-mail: kasimdurmus5@gmail.com

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The most common definition of sudden sensorineural hearing loss (SSNHL) that was defined by De Kleyn et al., in 1944 for the first time is made according to audiological and temporal parameters.[1,2] A hearing loss of more than 30 dB at 3 consecutive frequencies within 3 days is defined as idiopathic SSNHL (ISSNHL), which is a common medical emergency.[3] Even though this type of hearing loss influences especially elders, it is seen at every age. Its incidence is estimated to be 10–20/100,000/year, but in fact it is probably much higher because it is increasingly seen in industrialized countries and most of cases are frequently misdiagnosed or considered as age-related unavoidable disorder.[4,5]

SSNHL has a sophisticated course with possible multiple etiologies and treatment modalities. The etiology of SSNHL is usually unknown and is therefore frequently considered as ISSNHL. Despite the lack of well-clarified etiology of ISSNHL, some theories concerning the reason of injury in such situations indicate vascular injury, rupture of membranes, viral or bacterial infection, and immune mediated injury.[6]

Being known to influence human health for many years,[7] seasonal climatic changes are effective on both the development of sudden deafness and its healing. Because of only few reports on ISSNHL associated with weather conditions, the relationship between them has not been completely clarified. In this regard, general characteristics of the weather such as atmospheric pressure and temperature as well as their variation and covariation have been commonly investigated.[8–14]

The results of studies assessing the relationship between ISSNHL and parameters of weather condition in the literature are different from the results of the studies we could reach. Our clinical observations revealed that the number of cases with ISSNHL increased in certain periods. Because the number of studies investigating the effects of weather and seasonal changes on incidence of ISSNHL in the literature is limited and the results vary, we aimed to investigate whether or climatic conditions of the region where we live and meteorological parameters had any effect on pathogenesis and prognosis of ISSNHL or not.

Materials and Methods

Study population

Sixty-eight consecutive ISSHL patients, who were treated at our department, were examined retrospectively. Definition of ISSNHL is a hearing loss of at least 30 dB in 3 consecutive frequencies in 72 hours.[3]

Exclusion and inclusion criteria, which were based on the study of Durmuş et al.[15] on ISSNHL cases, were used in our clinic in the present study and both situations were described below. Inclusion criteria were as follows: applying to hospital within one week from the onset of the disease, no history of steroid treatment, and undergoing pure tone hearing test during the first visit. Exclusion criteria were as follows: having an acute inflammation, infection, a history of otologic surgery, trauma or barotrauma during the previous 4 weeks, cerebellopontine angle pathology or congenital cochlear malformations, neurologic disorders predisposing to hearing loss, the recent use of ototoxic medications, neoplasm within the previous 2 years, or other major diseases (such as heart failure, hypertension, coronary artery disease, cor pulmonale, liver or renal dysfunction, diabetes mellitus, chronic obstructive pulmonary disease, obstructive sleep apnea, connective tissue diseases, and inflammatory bowel diseases), any otologic disease such as otitis media during the last 4 weeks, chronic otitis media, otosclerosis, and Meniere's disease.

All of the cases included in the study were applied with standard treatment protocol which is applied to patients diagnosed with ISSNHL in our clinic. The protocol is as follows: All of the patients were administered methylprednisolone (1 mg/kg i.v. per day Prednol-L ampoule, Mustafa Nevzat Drug Industry, Istanbul, Turkey), with a dose tapering by 10 mg per two days maintained for at least 2 weeks. On the corticosteroids, the patients were administered with the H2 receptor inhibitor ranitidine 1x1 ampoule i.v. (Ulcuran ampoules 50 mg/2 Ml i.v. Yavuz Drug Industry, Istanbul, Turkey), oral vitamin B1 (2×250 mg thiamine hydrochloride) and B6 (250 mg pyridoxine hydrochloride; Nerox B tablet, Abdi İbrahim Pharmaceutical Company, Istanbul, Turkey) for a period of three months. Then, 100 mg pentoxifylline (Vasoplan AMP 100 mg/5 ml Mustafa Nevzat Drug Industry, Istanbul, Turkey) was added into 500 ml Voluven (Fresenius Kabi AG, Oberursel, Germany) and given via intravenous infusion. The dose of pentoxifylline was added every two days and it took eight days to administer the treatment.

The approval of Ethical Committee was received and the study was conducted in accordance with the Helsinki Declaration. Informed consent of all the participants was received.

Meteorological data

The study was conducted for three years (March 2015 to June 2017) in the province of Sivas, being located in Northeastern Turkey and having a population of about

621,224 people. Meteorological data including monthly ambient temperature, relative humidity, atmospheric pressure, rainfall, and maximum and minimum temperatures obtained at observation station of the Central Weather Bureau of Sivas were used.

Being a relatively small city, Sivas has a total surface area slightly larger than 28,619 km^2. Therefore, meteorological data in a period of 10 days before onset of the disease (the day on which patient stated their complaints started was considered as the day 1) and in a period of 21 days since the beginning of the treatment (to cover the whole period of medical treatment) were used to investigate the relationship between climatic data and ISSNHL.

During the study period, temperature ranged from -21°C (February) to 38.1°C (July) and relative humidity was between 96% (January) and 24.9% (April). Pressure ranged from 853.1 hPa (February) and 880.4 hPa (February). Since Sivas province is geographically located in a high region, pressure less than 1000 hPa is considered as normal. Maximum rainfall during the study period was 24.1 kg/m^2 (May).

Also in the present study, each year was divided into four seasons in order to obtain seasonal distribution of ISSNHL: spring (March 1 – May 31), summer (June 1 – August 31), autumn (September 1 – November 30), and winter (December 1 – February 28/29).

Audiological assessment

Hearing data of all of 68 cases were obtained by using AC-40 Interacoustics Clinic Audiometer (Interacoustics, Assen, Denmark) at baseline and after the treatment (at the end of the 4th week) and they were recorded in the audiological evaluation form of each patient.

All of the ISSHL patients were subject to a standard evaluation including a pure-tone speech audiometry. Pure tone thresholds were obtained for air conduction at 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, and 6 kHz and for bone conduction at 250 Hz, 500 Hz, 1 kHz, 2 kHz, and 4 kHz, respectively. Audiologic data were reported via the methods suggested by the Hearing Committee of the American Academy of Otolaryngology Head and Neck Surgery. Based on Siegel's criteria,[16,17] a classification was made in accordance with the treatment success and pure tone averages were observed during the follow-ups one month later. ISSNHL patients were divided into four subgroups by considering whether their pure tone averages (PTA) pointed out complete, partial, slight and no recovery or not. Complete recovery was defined as a final pure tone audiometry result <25 dB, and partial recovery as an improvement of >15 dB, but final hearing of 25–45 dB. Slight recovery was defined as an improvement of >15 dB, but final hearing >45 dB; and no recovery was defined as a hearing improvement of <15 dB and final hearing of >75 dB.

Statistical analysis

The data were analyzed by using the Statistical Package of Social Science (SPSS Inc., Chicago, IL, USA) for Windows version 23.0.

Additionally, SSNHL values of patients as well as periodical climatic data were also added in data set used in the study. At the application stage of analyses, normality was tested via Kolmogorov-Smirnov Z test. Because variables met normal distribution, independent samples t-test and related samples t-test were performed in order to test the mean differences between two categorical variables. F-test was performed for testing multiple categorical variables. Presentations were also prepared with the aid of demographic and disease data of the patients. The tests carried out were interpreted at confidence level of 95%.

Results

Sixty-eight ISSNHL patients who had a mean age of 46.81±16.045 (range: 13 to 78) years were included in the study.

Thirty-one patients were male (45.6%) and 37 were female (54.4%). The mean age was 51.46±15.70 (range: 15 to 78) years in female patients and 41.26±14.85 (range: 13 to 75) in male patients.

All the cases had a unilateral hearing loss [right ear was 45.6% (n=31) and left ear was 54.4% (n=37)]. Pre-treatment and post-treatment PTA values of ears with hearing loss in patients with ISSNHL were 47.89±28.95 and 40.19±29.93 ($p<0.001$) for the left ear and 59.16±24.83 and 51.10±27.76 ($p<0.001$) for the right ear, respectively.

According to Siegel's criteria, complete recovery was observed in 30 (44.12%) patients, slight recovery in 14 (20.59%) patients, and no recovery in 24 (35.29%) patients.

When examining the distribution of 68 patients, included in the study, by months in a 3-year period, it was observed that patients with ISSNHL were observed almost every month ($n_{max(March)}=14$; $n_{min(September)}=1$) (**Fig. 1**). When distribution of the patients with ISSNHL was evaluated by seasons, 23.52% ($n_{wint}=16$) patients were observed in winter months, 39.70% ($n_{spring}=27$ in spring months, 26.47%

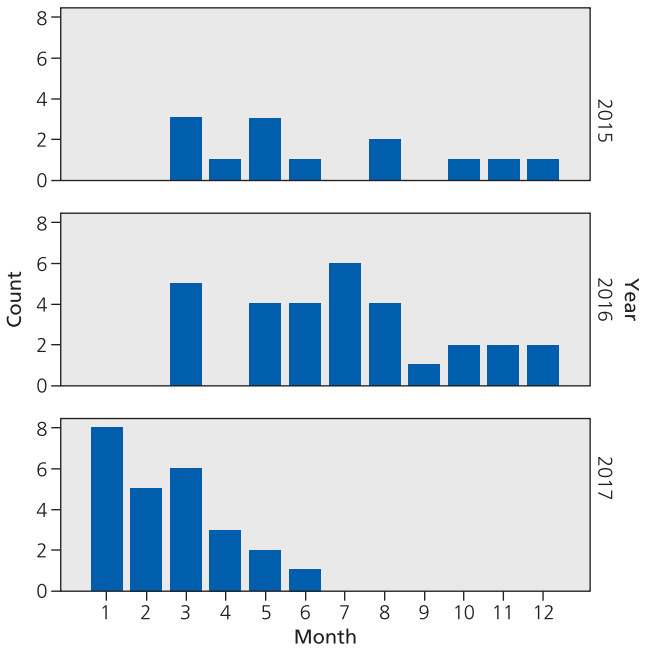

Fig. 1. The distribution of ISSNHL by months and years.

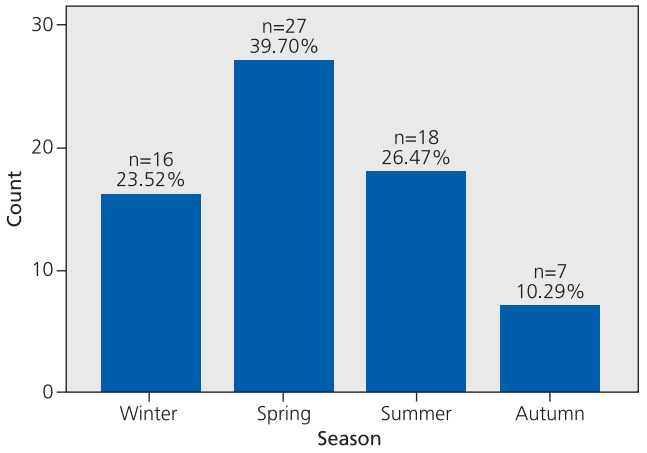

Fig. 2. The seasonal distribution of ISSNHL.

(n_{summ}=18) in summer months, and 10.29% (n_{autumn}=7) in autumn months, respectively. When distribution of the patients by seasons was assessed statistically, it was observed that there was a statistically significant correlation between ISSNHL and seasons (p<0.05; p=0.008) (**Fig. 2**).

When hearing recovery level of the patients with ISSNHL by seasons was assessed according to Siegel's criteria, it was remarkable that those with complete recovery were rather in summer and spring months; on the other hand, those with no recovery were intense among the patients diagnosed during winter. This variation between Siegel's criteria and the season was statistically significant (p<0.001) (**Table 1**).

Based on the day when complaints of the patients with ISSNHL started, meteorological parameters included 10 days before the onset of symptoms and in the 21-day treatment period by accepting that the starting day of the treatment was the first day were summarized in **Table 2**. As it can be seen in the table, there was a statistically significant difference between 10-day period before the onset of symptoms and 21-day treatment period in meteorological parameters in the period evaluated (p<0.001).

When hearing recovery of the patients with ISSNHL according to Siegel's criteria and meteorological parameters were evaluated, a statistically difference was determined between minimum, maximum and mean weather temperatures, minimum pressure and rainfall during pretreatment 10-day period. Additionally, there was a statistical correlation between only the rainfall among meteorological parameters and recovery of the patients based on Siegel's criteria during 21-day treatment period (p<0.005) (**Table 3**).

Table 1. The distribution of the patients with ISSNHL by seasons based on Siegel's criteria.

Seasons	On the basis of Siegel's criteria			p-value
	Complete recovery n (%)	Slight recovery n (%)	No recovery n (%)	
Winter	1 (6.25%)	3 (18.75%)	12 (75.0%)	**0.002**
Spring	15 (55.6%)	1 (3.7%)	11 (40.7%)	**0.003**
Summer	12 (66.7%)	5 (27.8%)	1 (5.6%)	**0.006**
Autumn	2 (28.6%)	5 (71.4%)	0 (0%)	0.257
	<0.001	0.370	**0.010**	

Table 2. Mean value of each meteorological parameter on the 10-day period prior to the onset of symptoms and the 21-day period from the start of medical treatment.

Meteorological parameter		Mean±SD	Minimum	Maximum	p-value
T_{min} (°C)	Before	3.70±7.30	-9.98	16.39	**<0.001**
	After	3.80±7.91	-10.28	15.70	
T_{max} (°C)	Before	15.92±10.12	.11	33.03	**<0.001**
	After	16.52±10.44	-2.26	32.46	
T_{mean} (°C)	Before	9.30±8.65	-5.27	23.90	**<0.001**
	After	9.60±9.10	-6.54	23.06	
RH	Before	61.04±10.30	42.97	80.01	**<0.001**
	After	60.92±9.27	48.08	77.92	
Rf	Before	1.34±1.34	.00	5.29	**<0.001**
	After	1.22±1.17	.00	5.41	
P_{min}	Before	869.73±2.30	865.47	874.93	**<0.001**
	After	870.25±2.35	866.03	877.16	
P_{max}	Before	873.31±2.31	869.44	878.95	**<0.001**
	After	873.72±2.42	87.30	880.27	
P_{mean}	Before	871.71±2.24	867.61	876.86	**<0.001**
	After	872.12±2.32	868.64	878.79	

P_{max}: maximum atmospheric pressure; P_{mean}: mean atmospheric pressure; P_{min}: minimum atmospheric pressure; **RH:** relative humidity; **Rf:** rainfall; T_{max}: minimum temperature; T_{mean}: mean temperature; T_{min}: maximum temperature.

Table 3. Mean values of meteorological parameters and difference analysis results based on Siegel's criteria.

Meteorological parameter		Siegel's criteria	N (%)	Minimum	Maximum	Mean±SD	p-value
T_{min} (°C)	Before	1	30 (44.11%)	-6.88	16.07	6.43±6.91	0.017[a]
		3	14 (20.58%)	-9.13	16.39	2.46±7.56	
		4	24 (35.29%)	-9.98	13.49	1.01±6.66	
T_{max} (°C)	Before	1	30 (44.11%)	1.43	33.03	19.51±10.01	0.028[b]
		3	14 (20.58%)	1.36	32.73	14.08±10.32	
		4	24 (35.29%)	.11	29.98	12.51±9.00	
T_{mean} (°C)	Before	1	30 (44.11%)	-2.91	23.81	12.46±8.43	0.021[c]
		3	14 (20.58%)	-4.42	23.90	7.76±8.84	
		4	24 (35.29%)	-5.27	21.20	6.24±7.73	
Rf	Before	1	30 (44.11%)	.00	5.18	1.16±1.35	0.039[d]
		3	14 (20.58%)	.02	1.99	.83±.77	
		4	24 (35.29%)	.07	5.29	1.88±1.46	
Rf	After	1	30 (44.11%)	.00	3.53	.87±.85	0.016[e]
		3	14 (20.58%)	.02	3.54	1.03±.91	
		4	24 (35.29%)	.00	5.41	1.76±1.47	
P_{min}	Before	1	30 (44.11%)	866.47	873.62	869.60±1.86	0.037[f,g]
		3	14 (20.58%)	866.58	874.10	871.06±2.19	
		4	24 (35.29%)	865.47	874.93	869.11±2.62	

P_{min}: minimum atmospheric pressure; **Rf:** rainfall; T_{max}: minimum temperature; T_{mean}: mean temperature; T_{min}: maximum temperature.

[a]The difference was caused by Siegel 1–4 groups (p=0.006). [b]The difference was caused by Siegel 1–4 groups (p=0.011). [c]The difference was caused by Siegel 1–4 groups (p=0.008). [d]The difference was caused by Siegel 1–4 groups (p=0.048). [e]The difference was caused by Siegel 1–4 groups (p=0.005). [f]The difference was caused by Siegel 1–3 groups (p=0.047). [g]The difference was caused by Siegel 3–4 groups (p=0.012).

Discussion

The aim of the present study was to investigate if climatic conditions and meteorological parameters of the region where we have been living had any effect on development of ISSNHL and/or recovery level of patients' hearing or not. Therefore, primarily the change between the diagnosis and treatment periods of the cases with ISSNHL in terms of parameters obtained from meteorology unit was revealed statistically. The results obtained from the present study indicate that when considering the climatic conditions of our region, the patients with ISSNHL were observed almost every month during the 3-year period; however, the patients were observed more frequently in especially spring, and when the patients were classified by Siegel's criteria in terms of recovery in hearing levels, complete recovery was observed mostly in the patients diagnosed and treated in summer and spring months (Siegel 1), while the worst outcomes of treatment were observed in the patients diagnosed and treated in winter months (Siegel 4).

SSNHL is a type of hearing loss with no exact reason developing in a relatively short time and is a common otolaryngologic entity. It has an unclear etiology. The pathogenesis of this disease has been suggested by different theories such as inflammatory, vascular, traumatic, metabolic, neoplastic, and ototoxic.[16] Thus, once all other possible pathological entities causing SSNHL were excluded, ISSNHL is most often diagnosed.

Since the argument suggested by Hippocrates in the 5th Century for the first time, studies have been conducted for centuries indicating that climatic changes may have effects on human health. Because its etiology has not been known exactly yet, the effects of climate on etiology, incidence, and prognosis in patients with ISSNHL have become subject in various studies in the literature. The first study, which we could access upon literature review on this issue, was published by Mess et al.,[8] in 1984. This study was conducted retrospectively on more than 500 patients with SSNHL living in the region of Munich and a statistically significant correlation with the data of weather condition was shown. The results obtained from the study of Hebert et al.[9] on a possible relationship between weather condition and Bell's palsy, acute unilateral vestibular disorder, Meniere's disease, and sudden hearing loss, abstract of which we accessed via PubMed database, pointed out that these diseases were observed more frequently in low pressure conditions. The present study included the patients living in Sivas province. Due to geographical location, Sivas is located in a low pressure area. When minimum, maximum, and mean pressure values of pre-diagnosis 10-day period and 21-day treatment period were compared, pressure values in the period of the disease onset were observed to be lower in a statistically significant way. These results are similar to the results of the study of Herbert et al.[9] Mizukoshi et al.[10] pointed out in their study that there was no relationship between cold weather and incidence of SSNHL. When an evaluation was made in terms of weather temperature and recovery in hearing level of patients, the results obtained from our study revealed that mean, minimum, and maximum temperatures in the 10-day period before the disease were high, which led to better recovery rates.

In the study performed by Preyer[11] to investigate the correlation between incidence, degree of hearing loss, remission and atmospheric pressure and temperature in 128 patients with ISSNHL for a 12-month period, it was observed that while the minimum differences were observed for atmospheric pressure and temperature in the patient group with completely recovered hearing threshold, the same parameters were higher for the patients with hearing loss. However, the disease did not have a statistically significant correlation with pressure and temperature. In addition, a correlation between disease and season was not revealed. When considering the results obtained from the present study, they were different from the results of this study. For example, disease was observed mostly in spring in our patient group. The results of the present study were also remarkable regarding the fact that the rates of complete recovery were higher in patients who were diagnosed with ISSNHL mostly in summer and spring compared to those diagnosed in other seasons. Nonetheless, the rates of complete recovery were also higher in patients having high minimum, maximum, and mean temperature values in the period when they were diagnosed with ISSNHL. In conclusion, the results obtained from the present study were not similar to the results of the study of Preyer.[11]

In the study conducted by Danielides et al.[12] to investigate the effects of seasonal distribution of ISSNHL and variations and covariations of meteorological parameters such as temperature, humidity, atmospheric pressure on incidence of disease, the authors drew attention that there was no correlation between prevalence of disease and seasons and the incidence could not be significantly associated with any meteorological parameter or any weather type. According to our opinion, the most remarkable point of this study was that their results were only for the regions involving meteorological conditions dominating in Northwestern Greece. For example, although there was a relationship between disease and seasons in the present study, we con-

ducted it in a geography completely dominated by continental climate. Therefore, results of the present study were not compatible with the results of the study of Danielides et al.[12]

Lin et al.[13] investigated the relationship between specific weather conditions such as ambient temperature, relative humidity, atmospheric pressure, rainfall, and percentage of total sunshine in Taiwan and incidence of ISSNHL by using 5-year population data. Even though their results indicated that there were significant correlations between ambient temperature, relative humidity and incidence of ISSNHL for the total population, they determined that the significant relationship between incidence of ISSNHL and climatic parameters disappeared after arrangements made by seasonality, months, and trends. Consequently, the theory suggesting that weather is a triggering factor for pathogenesis of ISSNHL was not supported by this study.

In the study conducted by Ryu et al.[14] to evaluate whether prognosis of ISSNHL was associated with the initial season as well as the factors that may influence the prognosis in every season or not, they revealed that recovery rates of hearing of 318 patients did not show a significant difference by months and there was no correlation between mean temperature and daily temperature range in onset period of disease and recovery rates. This study revealed that recovery rates did not show a significant difference among patients with onset during these four seasons. The results of their study and the results of the present study did not support each other. However, while weather temperature was -6 to -3°C (January) in the coldest month, it was 23–27°C (August) in the hottest month in the region where Ryu et al.[14] conducted their study. During the three years of period when the present study was conducted, the coldest temperature in Sivas was -21°C observed in January, whereas the hottest temperature was 38.1°C observed in June. We are of opinion that the main reason why the results of two studies did not show similarity was different climate conditions. In the study of Narozny et al.,[17] the rates of hearing recovery were indicated to be higher in patients for whom disease developed in spring, which supports the results of the present study.

The last study in the literature which evaluated the effect of meteorological factors on ISSNHL and we could access was the one by Seo et al.[18] This study was conducted in a 6-year period and on 607 patients. The largest series of patients studied about this issue was included in this study. Analysis was also performed to evaluate the weather conditions occurring 1–7 days before ISSNHL onset and possible delayed effects of meteorological factors regarding the onset of disease. When the results of the study were evaluated, it was reported that mean and maximum wind velocity was higher in days when ISSNHL developed than the days that were not onset of ISSNHL, but a distinct relationship could not be established between any meteorological factor and onset of ISSNHL following the adjustment of multiple comparison value. In addition, maximum wind velocity had a distinct difference 5 days before onset of ISSNHL and it was pointed out that stronger wind velocity was likely to be associated with onset of ISSNHL.

Consequently, when the results of the present study were assessed with higher weather temperature in the pre-diagnosis period when the patients with ISSNHL were detected as well as the lower precipitation and the lower rainfall also in the 21-day treatment period, the rate of recovery in hearing loss was higher. The most important results making the present study different from other related studies in the literature are that it is the first study indicating that there might be a relationship between temperature in 10-day period before ISSNHL diagnosis, the rainfall in both pre-diagnosis and treatment periods and the prognosis of disease, and there might be a relationship between rainfall and both the pathogenesis and prognosis of ISSNHL.

Conclusions

The relationship between weather condition, meteorological parameters and diseases has become the subject in studies for long years. ISSNHL is also one of these diseases. The results obtained from the limited number of studies evaluating etiology, incidence, and prognosis of disease and meteorological parameters in the literature are different from the results of the our study. It was thought that these differences might be arising from the differences between both geographical locations and climatic conditions of the regions where the studies were conducted. However, we are of the opinion that the relationship between ISSNHL and temperature, pressure, rainfall and season obtained from some of previous studies and similarly from the present study should not be ignored. Therefore, we think that further multicenter studies including several regions and climatic conditions, and large case series are needed in order to evaluate the relationships between ISSNHL and season and meteorological parameters. In addition, it would not be right to assert that season and meteorological parameters have or do not have a possible role as a triggering factor in prognosis or pathogenesis of ISSNHL by only a single study without conducting a study involving wide geographical regions.

Conflict of Interest: No conflicts declared.

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