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ORIGINAL ARTICLE

Does Seasonal Variation Have an Effect on the Tendency and Severity of Idiopathic Sudden Sensorineural Hearing Loss?

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Objective: Since vascular disorders like myocardial infarct, migraine or glaucoma are thought to be influenced by weather conditions, we investigated the probable effects of seasonal variation on tendency and severity of idiopathic sudden sensorineural hearing loss.

Materials and Methods: This study included 164 patients who were diagnosed with idiopathic sudden sensorineural hearing loss. Patient files and audiograms were reviewed retrospectively regarding season of admittance, pure tone hearing levels and frequencies that hearing loss had occurred; hearing levels were classified according to pure tone thresholds and frequencies. The distribution of hearing loss levels of ISSHL (idiopathic sudden sensorineural hearing loss) according to seasons were evaluated by Pearson Chi-Square testing, the pure tone average levels according to seasons were evaluated by One-Way ANOVA. Also multiple comparison tests were performed by post hoc Tukey.

Results: Of 164 patients 71 (43.3 %) were male, 93 (56.7 %) were female. Hearing loss was moderate in 45.7 %, profound in 54.3 % of the patients. Among our series ISSHL was slightly more common in spring (31.7 %) and fall (28.6 %) than summer (16.5 %) and winter (23.1 %). Statistically when the dual comparisons of seasons according to hearing loss levels were performed, the hearing loss was more profound in winter compared to summer and spring ($p<0,001$; and $p<0,001$). In fall the hearing loss was more profound when compared to summer ($p=0,019$). In winter PTA results were significantly higher than summer and spring ($p=0,049$ and $p=0,011$).

Conclusion: Seasonal variation of hearing loss levels and hearing loss is significantly more profound in winter. These results encourage us to conduct more epidemiologic and pathophysiologic studies on this subject.

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Introduction

Sudden sensorineural hearing loss (SSHL) is a symptom of idiopathic cochlear injury. It is defined as a sensorineural hearing loss of 30 dB or more over at least three contagious audiometric frequencies that develops over a period of few hours to three days[1]. Ninety percent of the cases are unilateral. The prevalence of SSHL is equal in both men and women and is more likely to be observed among people of 30 to 60 years of age[2]. The estimated yearly incidence of SSHL is 5 to 20 cases per 100,000 persons[3,4].

Viral inflammation, vascular occlusive disease, and allergic reaction, rupture of intralabyrinthine membranes, local histamine production, and autoimmune disease are accused in ethipathogenesis of sudden sensorineural hearing loss (SSHL). However, in the majority of the cases, the cause of the pathology is still obscure and such cases are called as idiopathic sudden sensorineural hearing loss (ISSHL)[4,5,6,7]. The consideration of weather as a possible triggering factor of ISSHL has been either supported or contradicted by several authors[8-11]. No study has been performed about the relationship between severity of ISSHL and seasonal variation. In this study, we investigated the effects of seasonal variation on tendency and severity of ISSHL.

Materials and Methods

A retrospective review of the last 5 years' patient database was performed. All the patients were citizens of Ankara. Diagnosis of ISSHL was made after exclusion of the various possible causes of sudden sensorineural hearing loss. Data of onset of hearing loss was precisely recorded according to patients' history. Also meteorological data such as of seasons were recorded (Table 1).

Date of onset of hearing loss was precisely recorded according to patients' history. Detailed otorhinolaryngological examination, with specific attention on audiometry (tune fork tests, pure tone audiometry, speech discrimination tests, tympanometry and acoustic reflex) and vestibular function testing, as well as neurological evaluation were performed in all

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Table 1. The Distribution of Isshl (Idiopathic Sudden Sensorineural Hearing Loss) Patients According to Seasons

	Spring	Fall	Summer	Winter
2002	9	10	6	9
2003	11	9	8	8
2004	10	10	3	7
2005	12	8	7	5
2006	10	10	3	9

patients. Laboratory evaluation included hematological examinations (complete blood count, C-reactive protein, and erythrocyte sedimentation rate), coagulation studies, and serological chemical testing as well as tests for viral disease (including Hepatitis A, B, C, Herpes Simplex, HIV, Epstein-Barr, and Cytomegalovirus).

Patient files and audiograms were reviewed retrospectively regarding season of admittance, pure tone hearing levels and frequencies that hearing loss had occurred. According to pure tone thresholds, a decrement in threshold between 30 dB and 60 dB was accepted as "moderate hearing loss", more than 60 dB was accepted as "profound hearing loss". Hearing levels were also collected at low (125-500 Hz), mid (500-2000 Hz) and high (2000-8000) frequencies for determining the relationship of hearing levels according to frequencies. Seasonal distribution of ISSHL was performed by dividing the years into four conventional seasons: spring (1 March-31 May), summer (1 June-31 August), autumn (1 September-30 November), and winter (1 December- 28/29 February). The distribution of hearing loss levels of ISSHL (idiopathic sudden sensorineural hearing loss) according to seasons were evaluated by Pearson Chi-Square testing, The pure tone average levels according to seasons were evaluated by One-Way ANOVA. Also multiple comparison tests were performed by post hoc Tukey.

Results

The study included 164 patients who were diagnosed as ISSHL. Seventy one patients (43.3 %) were male, 93 (56.7 %) were female. Mean age was 49 years, with a range of 19 to 75 years. Moderate hearing loss was observed in 65 (45.7 %), severe hearing loss was observed in 89 (54.3 %) patients. There were 14 (%9) up-sloping, 17 (%10) down sloping, 25 (%15) u-shaped, 108 (%66) flat audiogram types.. Among our series incidence of ISSHL was slightly more common in spring (n=52, 31.7 %) and fall (n=47, 28.6 %) as compared with summer (n=27, 16.5 %) and winter (n=38, 23.1 %) respectively. The distribution of ISSHL according to seasons for each year is shown in Table 1. The distribution of hearing loss levels due to seasons is summarized in Figure 1. The distribution of pure tone averages due to seasons is shown in Table 2.

Clinically the profound hearing loss was most common in winter followed by fall and spring. The dual comparisons of seasons made by Pearson Chi square test showed that the hearing loss was more profound in winter compared to summer and spring ($p<0,001$; and $p<0,001$). In fall the hearing loss was more profound when compared to summer ($p=0,019$).

Clinically in winter the pure tone average results were higher than spring, fall and summer. Statistically (One-Way ANOVA,) ($p=0,006$). In winter PTA results were significantly higher than PTA results in summer and spring ($p=0,049$ and $p=0,011$ Post hoc Tukey) (Table 3). The seasonal comparisons between summer and spring; fall and spring; summer and fall; spring and fall were not statistically significant ($p>0,05$).

Discussion

SSHL is a clinical entity, and its etiology is still unclear. Unfortunately, a specific cause can be identified in only 10% of cases[12]. There is a high degree of variability in prognosis and treatment response[12]. Among these various etiologies, viral and vascular factors play central roles in the etiology. Vascular diseases are thought as meteorotropic but weather and disease relationship are not clear. It was suggested that weather changes initiate anomalous physiological and biochemical processes which changes in blood viscosity and clotting time and the toxicity of some drugs[13].

Vascular disorders like myocardial infarct, migraine or glaucoma are thought to be influenced by weather conditions. An association has been demonstrated between weather conditions and patients suffering from acute gouty arthritis, rheumatoid arthritis, SLE, and Behcet's disease[14-17]. The effect of weather conditions on Bell's palsy and Meniere's disease has also been searched and found that incidence of Meniere's disease and Bell's palsy was significantly affected by atmospheric pressure[18,19]. We investigated seasonal tendency of ISSHL and seasonal variation of hearing loss levels. Some authors reported that weather conditions are significantly correlated with the incidence of acute idiopathic hearing loss[18,19]. On the other side some authors could not find a statistically significant correlation between the incidence of the disease and the absolute values or relative alterations of

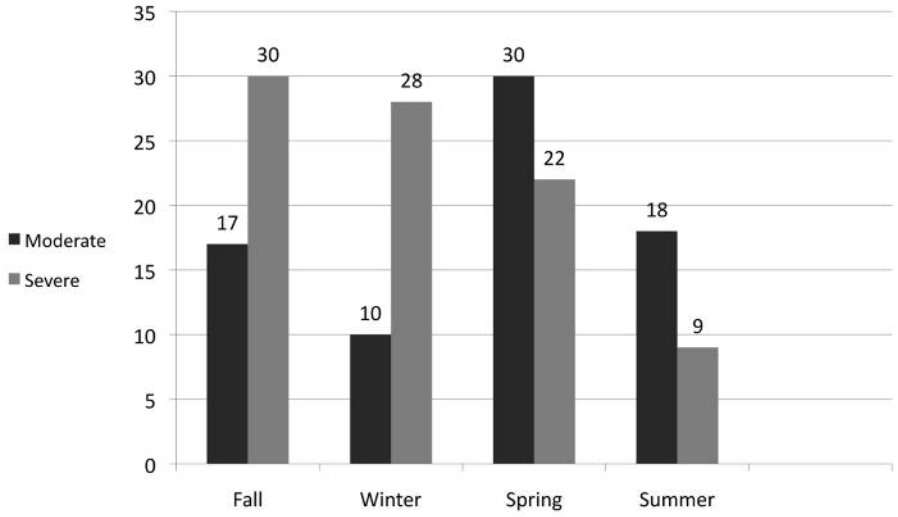

Figure 1. The Distribution of Hering Loss Levels of Isshl (Idiopathic Sudden Sensorineural Hearing Loss) According to Seasons

Table 2. Mean Pure Tone Average (PTA) Results According to Seasons

	Mean PTA	ANOVA
Spring	58,5±17,7	Dual comparisons of seasons according to PTA **p=0,006**
Fall	64,1±16,8	
Summer	54,6±15,9	
Winter	67,7±14,8	
Total	61,6±17,0	

Table 3. Multible Comparisons Between Seasons According to PTA (Post Hoc Tests)
Dependent variable: PTA

		Mean Difference	**Standant Error**	**Significance**
Spring	Fall	-5,6105	3,33	0,335
	Summer	3,9088	-9,1984	3,92
	Winter	3,53	0,752	**0.049**
Fall	Summer	9,5193	3,99	0,085
	Winter	-3,5879	3,61	0,753
Summer	Winter	-13,1072	4,16	**0,011**

atmospheric pressure and temperature as in our study[20]. This is the first report of a study that investigated relation of the severity of ISSHL and seasonal variations. Our results demonstrated that ISSHL was significantly more serious in winter. After hypothermic exposure an increase in plasma and blood viscosity has been reported[21]. A possible explanation of this rise may be the increase of thrombosis during in cold weather[21]. Acute severe hypothermia and also the mild prolonged hypothermia have similar impact on blood viscosity, packed cell volume and leucocytes[21]. We suggest that the severity of ISSHL may be increased due to the vascular changes as increase in plasma and blood viscosity, and rising number of viral infections during winter.

The vascular theory of sudden hearing loss emphasizes vascular compromise to the inner ear in the form of vascular occlusion, thrombosis, hemorrhage, or vascular spasm. There is a great deal of evidence both to support and refute a vascular etiology of ISSHL[12]. As Schuknecht noted, alterations in the microcirculation of the cochlea have long been supported to be a cause of ISSHL[4]. Fisch et al. have presented strong evidence of a vascular component to ISSHL[22]. Rising in blood and plasma viscosity may be the reason of increase of severity of ISSHL during winter.

Higher incidence of viral infections may be reason of more serious ISSHL disease during winter. Coexistence of upper respiratory tract infections in 25% of the cases has been detected and Nakashima et al. founded that 38.6% of patients with SSHL had common cold during the recent one month[6,7,23]. Viral infections can cause to abnormal cochlear flow and a strong immunologic response within the inner ear with

the production of a fibro-osseous matrix that is responsible for irreversible cochlear injury[5,6,24,25,26]. There are also clinical and experimental studies suggesting that SSHL is not commonly associated with a systemic viral infection[4,7,12].

In this study we investigated the probable effects of seasonal variation on tendency and severity of ISSHL. The results suggest that cold weather conditions are among the contributing factors on the development of profound hearing loss.

References

1. Wilson WR, Veltri RW, Laird N, Sprinkle PM. Viral and epidemiologic studies of idiopathic sudden hearing loss. Otolaryngol Head Neck Surg 1983;91:653–8.

2. Wilkins SA Jr, Mattox DE, Lyles A. Evaluation of a "shotgun" regimen for sudden hearing loss. Otolaryngol Head Neck Surg 1987;97:474–480.

3. Megighian D, Bolzan M, Barion U, Nicolai P. Epidemiologic considerations in sudden hearing loss: a study of 183 cases. Arch Otorhinolaryngol 1986; 243:250-253.

4. Schuknecht HF, Donovan ED. The pathology of idiopathic sudden sensorineural hearing loss. Arch Otorhinolaryngol 1986; 243:1–15.

5. Stokroos RJ, Albers FW, Schirm J. The etiology of idiopathic sudden sensorineural hearing loss: Experimental herpes simplex virus infection of the inner ear. Am J Otol 1998; 19:447–452.

6. Nakashima T, Itoh A, Misawa H, Ohno Y. Clinicoepidemiologic features of sudden deafness diagnosed and treated at university hospitals in Japan. Otolaryngol Head Neck Surg 2000;123:593-597.

7. Mattox DE, Lyles CA. Idiopathic sudden sensorineural hearing loss. Am J Otol 1989;10:242–247.

8. Mees K, Ruhenstroth-Bauer G, Sandhagen R, Baumer H, Filipiak B. Idiopathic hearing loss-dependent on the weather*?* Laryngol Rhinol Oto 1987;66:246–248.

9. Preyer S. Effect of weather on the incidence of sudden deafness. Laryngorhinootologie 1996; 75: 443 – 446.

10. Lin HC, Lee HC, Chao PZ, Wu CS. The effects of weather on the incidence of sudden sensorineural hearing loss: a 5-year population-based study. Audiol Neurootol 2006; 11:165-171.

11. Danielides V, Nousia CS, Bartzokas A, Lolis CJ, Kateri M, Skevas A. Weather conditions and sudden sensorineural hearing loss. BMC Ear Nose Throat Disord 2002; 17:2.

12. Anderson RG, Meyerhoff WL. Sudden Sensorineural Hearing Loss. Otolaryngol Clin North Am 1983; 16:189-195.

13. McGregor GR. Winter ischaemic heart disease deaths in Birmingham, United Kingdom: a synoptic climatological analysis. Clim Res 1999;13:17-31.

14. Shutty MS, Cundiff J, DeGood DE. Pain complaint and the weather:weather sensitivity and symptom complaints in chronic pain patients. Pain 1992; 49:199-204.

15. Arber N, Vaturi M, Schapiro JM, Jelin N, Weinberger A. Effect of Weather Conditions on Acute Gouty Arthritis. Scand J Rheumatol 1994; 23:22-24.

16. Jamison RM, Anderson KO, Slater MA. Weather changes and pain: perceived influence of local climate on pain complaint in chronic pain patients. Pain 1995; 61:309-315.

17. Krause I, Shraga I, Molad Y, Guedj D, Weinberger A. Seasons of the Year and Activity of SLE and Behcet's Disease. Scand J Rheumatol 1997;26:435-439.

18. Mair IWS, DeGraaf AS. Peripheral facial palsy in sub-arctic Norway. Acta Otolaryngol 1974;77:119-125.

19. Mizukoshi K, Watanabe Y, Shojaku H, Ito M, Ishikawa M, Aso S et al. Influence of a cold front upon the onset of Meniere's disease in Toyama, Japan. Acta Otolaryngol Suppl 1995;520:412-414.

20. Mees K, Ruhenstroth-Bauer G, Sandhagen R, Baumer H, Filipiak B. Idiopathic hearing loss-dependent on the weather? Laryngol Rhinol Oto 1987;66:246-248.

21. Ernst E, Matrai A, Scherer A. Increases in platelet and red cell counts, blood viscosity, and arterial pressure during mild surface cooling. Br Med J 1985; 290: 74.

22. Fisch U, Nagahara K, Pollak A. Sudden hearing loss: circulatory. Am J Otol 1984; 5:488-91.

23. Byl FM Jr. Sudden hearing loss: Eight years' experience and suggested prognostic table. Laryngoscope 1984; 94:647–661.

24. Tucci DL, Farmer JC Jr, Kitch RD, Witsell DL. Treatment of sudden sensorineural hearing loss with systemic steroids and valacyclovir. Otol Neurotol 2002; 23:301-308.

25. Zadeh MH, Storper IS, Spitzer JB. Diagnosis and treatment of sudden-onset sensorineural hearing loss: a study of 51 patients. Otolaryngol Head Neck Surg 2003; 128:92-8.

26. Chau JK, Lin JR, Atashband S, Irvine RA, Westerberg BD. Systematic review of the evidence for the etiology of adult sudden sensorineural hearing loss. Laryngoscope 2010; 120:1011-21.