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Original Research Article

Characteristics of patients with sudden onset sensorineural hearing loss: observational study

Naimova Zilola*, Saodat Kurbonbekova Mahmudova, Nilufar Jurakulovna Khushvakova

Department of Otorhinolaryngology, Samarkand State Medical University, Samarkand, Uzbekistan

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***Correspondence:**
Dr. Naimova Zilola,
E-mail: otorhyno.ssmu@gmail.com

ABSTRACT

Background: Sudden sensorineural hearing loss (SNHL) is considered as acute onset hearing disturbance characterized by hearing loss of greater than 30 decibels.
Methods: This retrospective research included data from 83 hospitalized patients (92 ears) and was conducted in a regional multidisciplinary children's medical centre between January 2014 and December 2019. We performed examinations of the eardrum as well as cranial nerves.
Results: Among the 92 ears with SNHL, 8 ears (8.7%) in age group of 2-18 years, 33 ears (35.9%) in the group of 19-30 years, 30 (32.6%) and 21 ears (22.8%) represented the age groups of 31-65 and those aged over 65 years respectively. Hearing loss in 5 ears (5,4%) was rated as light, in 7 ears (7.6%) as moderate, in 14 ears (15.2%) as severe, and 66 ears (71.7%) out of the 92 had profound degree of hearing loss. Early treatment of SNHL was positive predictive factor for recovery (OR=2.54, 95% CI 1.09-5.91, p=0.03). The presence of tinnitus was also strongly linked with better recovery outcomes while not significantly associated (OR=2.59, 95% CI 0.91-7.37, p=0.07).
Conclusions: In the course of our research, we found that 11.9% of patients made a full recovery, while the total recovery rate was 42.3%. Positive prognostic markers for hearing recovery were early treatment and a strong trend was observed with the presence of tinnitus.

Keywords: SNHL, Early treatment, Tinnitus, Observational study, Prognostic factors

INTRODUCTION

Sudden onset SNHL is considered as a hearing loss with quick start in less than three days. Additionally, the amount of hearing loss must be greater than 30 decibels in at least three frequencies that are contiguous.[1] In the United States, there are over 66,000 new cases of sudden sensorineural hearing loss per year, affecting 5 to 27 people out of every 100,000 people.[2] A number of case studies have shown that the usual onset of SNHL occurs between the ages of 46 and 49.[3] For SNHL, numerous prognostic variables have been investigated. The recovery rate was found to be inversely connected with more severe initial hearing loss, advanced age, vertigo, descending type of audiogram and cardiovascular risk factors such as diabetes, hypercholesterolemia and hyperglycemia.[4] Recently, it has been demonstrated that metabolic conditions such as diabetes, hyperlipidemia, and hyperglycemia are substantially connected to hearing loss recovery.[5]

The pathogenesis of SNHL is still not well understood. However, a number of reasons, including as viral infections, disturbances of microcirculation, autoimmune illnesses, and labyrinthine haemorrhage, have been identified as potential causes of the condition.[6,7] Microcirculatory abnormalities are thought to be the most likely cause of SNHL in adults, although viral infections are thought to be a significant component in the development of the condition.[7,8]

Study purpose

We aimed to investigate the clinical and audiological features, laboratory exams, and predictive variables of 83 patients with sudden onset SNHL.

METHODS

Patients and the overall study design

This retrospective research was carried out in a regional multidisciplinary children medical centre in Samarkand, Uzbekistan. This study included data from 83 hospitalized patients (92 ears) between January 2014 and December 2019. All of the patients provided their written permission after receiving appropriate information. Patients with SNHL who met the following inclusion criteria were considered for the study: a diagnosis of SNHL, an age of over 2 years and the availability of a full audiological report. Exclusion criteria were the age under the two years or any systemic disease were not included in this study. Additionally, people who had genetic or congenital deafness were not included in this study.

Ethical considerations

The study was approved by the ethics committee of Samarkand State Medical University.

Clinical examinations

For every patient with SNHL we performed the examinations of the eardrum as well as the cranial nerves. The audiometry tests were carried out using procedures that were designed with the patients' ages in mind. Both pure-tone audiometry and tympanometry were used to examine each patient's hearing and balance. The behavioral audiometry was used on children in their early years. The patient had the standard blood testing. Antibodies directed against viruses such as rubella, cytomegalovirus (CMV), herpes simplex were found.

We tested the hearing thresholds at 0.5, 1, 0, 2, and 4 kilohertz respectively. The levels of hearing impairment were ranked according to the scale developed by the World Health Organization.[9] According to the direction in which hearing loss occurred, there were five distinct configurations that may be detected on an audiogram: rising, sloping, flat, profound and U-shape.

According to the prognosis assessment, the patients were divided into four groups: total recovery, moderate recovery, modest recovery and no recovery. At the time of the last follow-up, the full recovery was determined to have occurred when the pure-tone average was below 25 dB. Hearing improvement of more than 30 dB was used to determine the partial recovery. Hearing improvement in the range of 15-30 decibels was used to identify the mild recovery. Patients whose hearing recovery was less than 15 dB were included as part of the group that did not recover. The total recovery rate was determined using patients who were categorized as having either a full recovery, a partial recovery or a modest recovery.[10]

Treatment

Patients were given any combination of the following therapy: short-term steroid injections combined with anti-inflammatory treatment, calcium antagonists, vasodilators, antivirals and medications for improving blood circulation and diuretics.[11]

Statistical analysis

When doing statistical analysis, R studio version 3.6.2 was used. In order to analyze clinical features of SSNHL and putative prognostic variables, a binary logistic regression analysis, Chi squared test for categorical variables, a non-parametric Mann-Whitney U test and Fisher's exact tests for continuous outcomes were carried out. Minimal required sample size was calculated as 45 patients taking into account the prevalence of orbital complications about 3%, under random sampling error of 5% with 95% confidence level. When p value was less than 0.05, we considered the results to be statistically significant.

RESULTS

Clinical characteristics of patients

Sudden onset SNHL was found in 92 ears total (83 patients); 51.1% of those ears came from men (47 ears), while 48.9 % of those ears came from females (45 ears). A total of 74 ears, or 80.4%, suffered from unilateral hearing loss, while 18 ears, or 19.6% were affected by hearing loss on both sides. The patients' average age was 42.2 years old when they were seen (range: 3-73 years). The majority of patients were hospitalized for a duration of maximum 12 days of therapy.

Among the 92 ears with SNHL, 8 ears (8.7%) were grouped under 2-18 years, 33 ears (35.9%) under 19-30 years group, 30 (32.6%) and 21 ears (22.8%) represented the age group of 31-65 and those aged over 65 years respectively.

Audiological characteristic

According to the examinations, hearing loss in 5 ears (5,4%) was rated as light, in 7 ears (7.6%) as moderate, in 14 ears (15.2%) as severe and 66 ears (71.7%) out of the 92 had profound degree of hearing loss (table 1). 3 ears (3.3%), were categorized as having an ascending audiogram curve, while 8 ears (8.7%) had a descending audiogram curve. 17 ears (18.5%) had a flat audiogram curve, 60 ears (65.2%), had a profound audiogram curve, and 6 ears (6.5%), had a U-shape audiogram curve (Table 2). The ABR was carried out on 86 ears, of these, the

waves I, III and IV were recognized in 12 ears (13.9%), however, wave V was only detected in 16 ears (18.6%). There were 58 ears that do not show any signs of ABR response (67.4%). Tympanometry was done on a total of 92 ears, and the results indicated that 86 of those ears (93.5%) had A type curves, whereas 6 of those ears (6.5%) had C type curves.

Age distribution in relation to the side of vertigo, tinnitus, and hearing loss was statistically significant (Table 3). There was no statistically significant difference in the age distribution between the sexes, ear fullness, vertigo, audiogram curve types or initial hearing loss.

Table 1: Characteristics of patients with SNHL (n=92 ears).

Characteristics		Mild n=5	Moderate n=7	Severe n=14	Profound n=66
Total		N (%)	N (%)	N (%)	N (%)
Form	Unilateral HL	5 (100)	5 (71.4)	12 (85.7)	52 (78.8)
Age (in years)	2-18	1 (20.0)	-	1 (7.1)	6 (9.1)
	19-30	1 (20.0)	2 (28.6)	4 (28.6)	26 (39.4)
	31-65	2 (40.0)	3 (42.9)	6 (42.9)	19 (28.8)
	>65	1 (20.0)	2 (28.6)	3 (21.4)	15 (22.7)
Symptoms	Ear fullness	1 (20)	1 (14.3)	4 (28.6)	9 (13.6)
	Tinnitus	3 (60.0)	6 (85.7)	12 (85.7)	52 (78.8)
	Vertigo	2 (40.0)	3 (50.0)	8 (57.1)	39 (59.1)

Table 2: Characteristics of audiograms in patients with sudden onset SNHL (n=92 ears).

Characteristics	Mild n=5	Moderate n=7	Severe n=14	Profound n=66
Total	N (%)	N (%)	N (%)	N (%)
Ascending	2 (40.0)	1 (14.3)	-	-
Descending	0 (0.0)	3 (42.9)*	2 (14.3)	3 (4.5)
Flat	1 (20.0)	2 (28.6)*	9 (64.3)*	5 (7.6)
Profound	-	-	3 (14.3)	58 (87.9)*
U-shaped	2 (40.0)	1 (14.3)	-	-

*p value less than 0.05 in Chi square or Fisher's exact tests; Ref-reference group.

Table 3: Distribution of characteristics of patients by age groups (n=92 ears).

Characteristics	2-18 years n=8	19-30 years n=33	31-65 years n=30	>65 years n=21
Total	N (%)	N (%)	N (%)	N (%)
Male	2 (25.0)	16 (48.5)	14 (46.7)	9 (42.9)
Unilateral hearing loss	4 (50.0)	27 (81.8)*	25 (83.3)*	18 (85.7)*
Ear fullness	1 (12.5)	4(12.1)	3 (10.0)	3 (14.3)
Tinnitus	2 (25.0)	29 (87.9)*	26 (86.7)*	19 (90.5)*
Vertigo	3 (37.5)	16 (48.5)	18 (60.0)*	13 (61.9)*

*p value less than 0.05 in Chi square or Fisher's exact tests.

Table 4: Laboratory examination of all SNHL patients in this study.

Parameters	Units	Mean±SD	Pathological cases N (%)
RBC	1012 l	3.8±1.1	29 (31.5)
WBC	109 l	10.8±5.4	31 (33.7)
PLT	liter	163.1±32.2	19 (20.7)
Triglyceride	mg/dl	121.9±24.6	6 (6.5)
Cholesterol	mg/dl	177.5±28.3	11 (11.9)
Total bilirubin	mg/dl	0.9±0.04	6 (6.5)
IgG Cytomegalovirus	mg/dl	1204.4±159.3	46 (50.0)

Continued.

Parameters	Units	Mean±SD	Pathological cases N (%)
Ig-Rubella virus	IU/ml	4.2±2.8	7 (7.6)
IgG-Herpes simplex virus	IV	0.79±0.04	18 (19.6)
IgE	IU/ml	201.4±45.2	16 (17.4)
IgM	mg/dl	189.3±35.4	6 (6.5)
IgA	mg/dl	212.5±53.8	4 (4.3)
IgG	mg/dl	849.9±153.8	1 (1.1)
Fibrinogen	mg/dl	233.4±103.3	13 (14.1)

Table 5: Multivariate analysis of predictive factors of recovery results in patients with SNHL.

Characteristics	Recovery (n=39)	No recovery (n=53)	Multivariate analysis		
	N (%)	N (%)	OR	95% CI	P value
Gender, male	21 (53.8)	28 (52.8)	1.04	0.45-2.38	0.92
2-18 years	2 (5.1)	6 (11.3)	Ref.		
19-30 years	10 (25.6)	23 (43.4)	1.30	0.22-7.61	0.29
31-65 years	12 (30.8)	18 (33.9)	2.00	0.34-11.6	0.77
>65 years	15 (38.5)	24 (45.3)	1.87	0.33-10.5	0.71
Late treatment (>7 days)	14 (35.9)	32 (60.4)	Ref.		
Early treatment (<7 days)	25 (64.1)	21 (39.6)	2.54	1.09-5.91	0.03
Vertigo (pres. vs abs.)	23 (58.9)	27 (50.9)	0.78	0.33-1.91	0.52
Tinnitus (pres. vs abs.)	33 (84.6)	36 (67.9)	2.59	0.91-7.37	0.07
Ear fullness (pres. vs abs.)	3 (7.7)	7 (13.2)	0.54	0.13-2.26	0.41
Mild	4 (10.2)	1 (1.9)	Ref.		
Moderate	4 (10.2)	3 (5.7)	0.33	0.02-4.73	0.81
Severe	5 (12.8)	9 (16.9)	0.13	0.01-1.60	0.11
Profound	30 (76.9)	36 (67.9)	0.20	0.02-1.96	0.17
Ascending	2 (5.1)	1 (1.9)	Ref.		
Descending	5 (12.8)	3 (5.7)	0.83	0.05-13.6	0.89
Flat	7 (17.9)	10 (18.9)	0.35	0.02-4.65	0.42
Profound	25 (64.1)	36 (67.9)	0.34	0.02-4.04	0.39
U-shape	2 (5.1)	3 (5.7)	0.33	0.01-6.67	0.47

In this study, 11.9 % or 11 ears, reported experiencing ear fullness. Tinnitus was reported by 82.6% of patients or 76 ears. vertigo was identified in 54.3% of patients or 50 ears. 12 ears or 13.0% affected by the infections of the upper respiratory tract. 6 ears or 6.5% reported fatigue, while in 4 patients (5 ears-5.4%) were found to have traumatic injuries.

42.4% of patients diagnosed with sudden onset SNHL had a full or partial recovery. Of these, 11.9% of patients had a total recovery, 19.6% a partial recovery and 10.9% had a minor or no improvement in their condition.

According to the findings of a multivariate study, a favorable link exists between hearing recovery and early treatment. The existence of tinnitus also showed a strong tendency towards significance. There was a trend of negative correlation between recovery and having severe to profound hearing loss, however, we found no statistically significant association. Tables 4 and 5 are found here.

DISCUSSION

In this study, 83 patients with sudden onset SNHL were identified. The number of patients with SNHL who had 92 ears was found to account for this percentage. Our data suggested that it was reasonable to suppose that infection with a virus was one of the primary contributors of sudden onset SNHL. According to findings from earlier research, the most common kind of hearing loss brought on by a CMV infection ranged from severe to profound and had a variable, progressive and delayed start. More than 90% of patients who had CMV infection may not exhibit any symptoms of having the infection and hearing loss was often bilateral in those who had a symptomatic infection, whereas hearing loss was typically unilateral in those who had an asymptomatic infection.[12] A standardized procedure for the prevention and treatment of CMV should also be considered in the clinical practice.

According to our data, SNHL more often occurred on one side which was consistent with the findings of an earlier investigation.[14] In addition, the relationship between bilateral SNHL and profound hearing loss was shown to be greater than the association between unilateral SNHL and more sever hearing loss. Majority of patients had either severe or profound hearing lost and profound audiogram patterns.

In the course of our research, all the patients were given immunological exams. 16 and 6 patients exhibited elevated IgE and IgM antibodies respectively. Antibodies in circulation may cause damage to the inner ear by reacting inappropriately with antigens found in the inner ear or T cells that have been activated.[5,7] As a consequence of this, an immunological mechanism was may be the cause of sudden SNHL.

Platelet levels were elevated in 31 individuals, which was an indication of enhanced blood coagulation. The promotion of thrombosis may lead to a disturbance in the cochlear microcirculation, which in turn can lead to an elevated risk of sudden onset SNHL. The findings suggested to use of thrombolytic medicines in patients diagnosed with SNHL. According to the findings of the current research, an elevated white blood cell count had a strong connection to the development of SNHL. Studies conducted in the past had shown that a negative prognostic factor of SSNHL was an increased quantity of neutrophils as well as an altered ratio of neutrophils to lymphocytes.[3,4,11] A standard blood test was performed on all 83 individuals for the purpose of this research, and 31 of those patients exhibited an elevated WBC. There was some evidence that a high WBC count may be a serological indication of sudden onset SNHL.

The levels of cholesterol and triglycerides in the blood of 6 individuals were found to be elevated. Blood lipid metabolic problems may cause lesions to form on the walls of blood vessels, increase blood viscosity and contribute to a disruption in the cochlear microcirculation.[12,15] Therefore, it seemed that the sudden onset SNHL maybe linked to increased amounts of lipids in the blood.

According to the findings of our research, early treatment was favorable prognostic variables of hearing recovery. Strong but not significant positive predictive markers for hearing recovery in SNHL patients included tinnitus and ascending type audiograms. It was discovered that age, vertigo, and ear fullness were not related to the rehabilitation process. It was common practice in SNHL to utilize the occurrence of vertigo as an indicator of poor recovery.[4-6] In the current research, patients who had abrupt hearing loss and vertigo accounted for 54.3% of all participants and there was no significant association between the two symptoms and the patients' ability to recover. There was ongoing discussion on whether or not tinnitus is related to the healing process. In some research, tinnitus was shown to be a significant favorable predictive factor of sudden onset SNHL.[11,14] For the purpose of this investigation 79.2% ears had tinnitus, with 45.2% of these making a partial or whole recovery. According to the multivariate analysis, it was revealed that the existence of tinnitus was a strong favorable factor linked with hearing recovery but not statistically significant.

The two most significant limitations of this research were observational methodology as well as the retrospective approach to data collection. We trained three independent PhD candidates for data collections, however it was possible that some pertinent information have been missed.

CONCLUSION

In conclusion, sudden onset SNHL is characterized by a predominant unilateral presentation and is associated with profound hearing loss. In the course of our research, we found that 11.9% of patients made a full recovery, while the total recovery rate was 42.3%. Positive prognostic markers for hearing recovery were early treatment and a strong trend was observed with tinnitus. Some immunologic indications, including CMV IgG and IgE antibodies were shown to have a strong connection to sudden onset SNHL.

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