



Naimova Z. ✉, Mahmudova S., Khushvakova N.
Samarkand State Medical University, Samarkand, Uzbekistan

Characteristics of Patients with Sudden Sensorineural Hearing Loss: An Observational Study

Conflict of interest: nothing to declare.

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Contacts: khasanibragimovuzb@gmail.com

Abstract

Purpose. We aimed to investigate the clinical, audiological, laboratory, and predictive factors of 83 patients with sudden onset SNHL.

Materials and methods. This retrospective study includes data of 83 hospitalized patients (92 ears), and was carried out in the regional multidisciplinary pediatric medical center in Samarkand between January 2014 and December 2019.

Results. Among the 92 ears with SNHL, 8 ears (8.7%) were in age group of 2–18 years, 33 ears (35.9%) were in age group of 19–30 years, 30 (32.6%) ears and 21 ears (22.8%) represented age group of 31–65 and those aged over 65 years respectively. Hearing loss in 5 ears (5.4%) was estimated as mild, in 7 ears (7.6%) as moderate, in 14 ears (15.2%) as severe, and in 66 ears (71.7%) of 92 a profound degree of hearing loss was present. Early treatment of SNHL was a positive predictor of recovery (OR=2.54, 95% CI 1.09–5.91, $p=0.03$). Presence of tinnitus was also strongly associated with better recovery outcomes, although there was no statistically significant association (OR=2.59, 95% CI 0.91–7.37, $p=0.07$).

Conclusions. Sudden onset of SNHL is characterized by a predominantly unilateral manifestation and is associated with profound hearing loss. In the our research, we found that 11.9% of patients fully recovered, and the overall recovery rate was 42.3%. Early treatment was a positive predictor for hearing recovery. Patients with tinnitus also tended to recover, although the data were not statistically significant. Some immunologic indices, including CMV IgG and IgE antibodies were shown to have a strong connection to sudden onset SNHL.

Keywords: SNHL, early treatment, tinnitus, observational study, prognostic factors

Наимова З.С. ✉, Махмудова С.К., Хушвакова Н.Ж.

Самаркандский государственный медицинский университет, Самарканд, Узбекистан

Характеристики пациентов с внезапной нейросенсорной тугоухостью: наблюдательное исследование

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Контакты: khasanibragimovuzb@gmail.com

Резюме

Цель. Изучить клинические, аудиологические, лабораторные и прогностические факторы 83 пациентов с внезапной нейросенсорной тугоухостью (ВНСТ).

Материалы и методы. Ретроспективное исследование включало данные 83 госпитализированных пациентов (92 уха) с ВНСТ и проводилось в региональном многопрофильном детском медицинском центре. Для статистических анализов использовалась R-studio версии 3.6.2. Проводился множественный логистический регрессионный анализ, параметрические и непараметрические тесты.

Результаты. У большинства пациентов наблюдалась односторонняя потеря слуха (74 уха) и тяжелые степени нарушения слуха (64 уха). Среди 92 ушей с ВНСТ потеря слуха в 5 ушах (5,4%) была оценена как легкая, в 7 ушах (7,6%) – как умеренная, в 14 ушах (15,2%) – как тяжелая, а в 66 ушах (71,7%) из 92 была глубокая степень потери слуха. Раннее лечение ВНСТ было положительным прогностическим фактором для выздоровления (ОШ=2,54, 95% ДИ 1,09–5,91, $p=0,03$). Наличие шума в ушах также было тесно связано с лучшими результатами восстановления, хотя статистически значимой связи не было (ОШ=2,59, 95% ДИ 0,91–7,37, $p=0,07$).

Выводы. Внезапная нейросенсорная тугоухость характеризуется преимущественно односторонним проявлением и ассоциируется с глубокой потерей слуха. В ходе исследования мы обнаружили, что 11,9% пациентов полностью выздоровели, а общий процент выздоровления составил 42,3%. Положительным прогностическим маркером для восстановления слуха было раннее лечение. Пациенты с шумом в ушах также имели тенденцию к выздоровлению, хотя данные не были статистически значимыми.

Ключевые слова: ВНСТ, раннее лечение, шум в ушах, наблюдательное исследование, прогностические факторы

■ INTRODUCTION

Sudden sensorineural hearing loss (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 such as viral infections, disturbances of microcirculation, autoimmune illnesses, and labyrinthine hemorrhage, 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 [7] although viral infections are thought to be a significant component in the development of the condition [8].

■ PURPOSE OF THE STUDY

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

■ MATERIALS AND METHODS

Patients and the Overall Study Design

This retrospective research was carried out in the regional multidisciplinary children medical center in Samarkand, Uzbekistan. This study includes data from 83 hospitalized patients (92 ears) between January 2014 and December 2019. All of the patients provided their written consent after receiving appropriate information. Patients with SNHL who met the following inclusion criteria were considered for the study: SNHL diagnosed, 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 not included in this study. Additionally, subjects with genetic or congenital deafness were not included in this study.

Clinical Examinations

For every patient with SNHL we performed examinations of the eardrum and the cranial nerves. Audiometric tests were performed using age-appropriate procedures. Both pure-tone audiometry and tympanometry were used to examine each patient's hearing and balance. Behavioral audiometry was applied in young aged children. The patient underwent standard blood testing. Antibodies directed against viruses such as rubella, cytomegalovirus (CMV), and herpes simplex were found.

We tested 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 are five

distinct configurations that may be detected on audiogram: rising, sloping, flat, profound, and U-shape.

According to 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 one of combination of the following therapy: short-term steroid injections combined with anti-inflammatory therapy, 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 multivariate 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. When p-value was less than 0.05, we considered the result to be statistically significant.

■ RESULTS

Clinical Characteristics of Patients

Sudden onset SNHL was found in 92 ears (83 patients); 51.1% of these ears were male (47 ears) and 48.9% of the ears were female (45 ears). A total of 74 ears, or 80.4% of all ears, 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 at the moment of observation (range: 3–73 years). The majority of patients were hospitalized for a duration of maximum 12 days of therapy.

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

Total	Characteristics	Mild N (%) n=5	Moderate N (%) n=7	Severe N (%) n=14	Profound N (%) n=66
Form	Unilateral HL	5 (100%)	5 (71.4%)	12 (85.7%)	52 (78.8%)
Age	2–18 years	1 (20.0%)	–	1 (7.1%)	6 (9.1%)
	19–30 years	1 (20.0%)	2 (28.6%)	4 (28.6%)	26 (39.4%)
	31–65 years	2 (40.0%)	3 (42.9%)	6 (42.9%)	19 (28.8%)
	>65 years	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%)

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 examinations, hearing loss in 5 ears (5.4%) was rated as mild, 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). 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 side of vertigo, tinnitus, and hearing loss was statistically significant (Table 3). There was no statistically significant difference in the age distribution between gender, ear fullness, vertigo, audiogram curve types, or the level initial hearing loss.

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.

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

Characteristics	Mild N (%)	Moderate N (%)	Severe N (%)	Profound N (%)
Total	n=5	n=7	n=14	n=66
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)	–	–

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

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

	2–18 years n (%)	19–30 years n (%)	31–65 years n (%)	>65 years n (%)
Total	N=8	N=33	N=30	N=21
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)*

Note: * 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	10 ¹² l	3.8±1.1	29 (31.5)
WBC	10 ⁹ 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)
IgG – 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)

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

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

Characteristics	Recovery (n=39)	No recovery (n=53)	Multivariate analysis		
			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

According to the findings of a multivariate study, a favorable link exists between hearing recovery and early treatment. The existence of tinnitus showed also 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.

■ 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 suggests that it is reasonable to suppose that a viral infection is 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 ranges from severe to profound and has a variable, progressive, and delayed start. More than 90% of patients who have CMV infection may not exhibit any symptoms of having infection, and hearing loss is often bilateral in those who have a symptomatic infection, whereas hearing loss is typically unilateral in those who have an asymptomatic infection [12]. A standardized procedure for CMV prevention and treatment 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 severe hearing loss. Majority of patients had severe or profound hearing loss, 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 may be the cause of sudden SNHL.

Platelet levels were elevated in 31 individuals, indicating 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 suggest using of thrombolytic medicines in patients diagnosed with SNHL. According to current research findings, an elevated white blood cell count appears strongly associated to the development of SNHL. Studies conducted in the past have shown that a negative prognostic factor of SSNHL is an increased quantity of neutrophils as well as an altered ratio of neutrophils to lymphocytes [3, 4, 11]. Standard blood tests were performed in all 83 individuals for the purpose of this research, and 31 of those patients exhibited an elevated WBC. There is some evidence that a high WBC count may be a serological indication of sudden SNHL onset.

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 our research findings, an early treatment is favorable prognostic predictor 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 rehabilitation process. It is 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 is 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 SNHL onset [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.

■ CONCLUSIONS

In conclusion, sudden onset SNHL is characterized by predominantly 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 marker for hearing recovery was early treatment, and strong trend was observed with tinnitus. Some immunologic indications, including CMV IgG and IgE antibodies were shown to be strongly associated with sudden onset SNHL.

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