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Analysis of Characteristics and Prognostic Factors of Full-Frequency Idiopathic Sudden Sensorineural Hearing Loss with Hyperlipidemia

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Purpose: To explore the relationship between hyperlipidemia and full-frequency idiopathic sudden sensorineural hearing loss (FFHL).

Patients and Methods: A total of 145 FFHL patients admitted from September 2021 to May 2024 were analyzed. Eighty-five patients with hyperlipidemia and 60 patients with normal serum lipids statistically analyze the patient's gender, age, onset time, accompanying symptoms, and serum lipids. Measure the pure tone hearing threshold before and after treatment, and calculate the average increase in hearing threshold. Compare the correlation between various factors and prognosis.

Results: The hyperlipidemia group had a higher proportion of males (P=0.043) and vertigo (P=0.044) compared to the control group, while other information between the two groups lacked statistical significance. Effective patients (n=44) in the hyperlipidemia group showed significant differences in vertigo (P=0.020), age (P=0.032), and onset (P=0.030) compared to ineffective patients (n=41). Analysis showed that these were independent correlated factors affecting prognosis. Other indicators, including serum lipids, have no significance in predicting the prognosis of patients with hyperlipidemia and complete frequency decline in hearing loss.

Conclusion: Patients with hyperlipidemia have higher rates of males and vertigo. The age, onset, and vertigo of patients with hyperlipidemia are related to prognosis, while various lipid indicators are not related to the prognosis of sudden hearing loss.

Keywords: hyperlipidemia, idiopathic sudden sensorineural hearing loss, full frequency hearing loss

Introduction

Idiopathic sudden sensorineural hearing loss (ISSNHL) refers to unexplained sensorineural hearing loss that occurs within 72 hours. The hearing loss at two consecutive frequencies should exceed at least 20 dB.[1,2] According to the guidelines, sudden hearing loss can be divided into low-frequency hearing loss, high-frequency hearing loss, flat-frequency hearing loss, and total hearing loss.[1] Due to the belief that both are related to microcirculatory disorders, flat type, and total hearing loss type SD can be classified as full-frequency idiopathic sudden sensorineural hearing loss (FFHL), which means a type of ISSNHL with hearing level decreases at all frequencies.[1] Multiple blood test indicators are believed to be associated with ISSNHL.[3,4] Hyperlipidemia usually refers to an increase in triglycerides and/or total cholesterol in the plasma, an increase in low-density lipoprotein cholesterol, and a decrease in high-density lipoprotein cholesterol. When ≥1 of the following fasting venous plasma test indicators is met, abnormal blood lipids can be diagnosed: Total cholesterol (TC) ≥ 6.2 mmol/L; Low density lipoprotein cholesterol (LDL-C) ≥ 4.1 mmol/L; Triglycerides (TG) ≥ 2.3 mmol/L; high-density lipoprotein cholesterol (HDL-C) < 1.0 mol/L. The occurrence of this disease can be seen in people of different ages and genders, especially in the 50–69 age group, with a clear genetic predisposition.[5] Research has shown that hyperlipidemia can have an impact on the microvascular function of the inner ear, leading to ischemia and edema of the inner ear tissue, and hearing damage.[6] But there are many conflicting studies on whether hyperlipidemia has an impact on ISSNHL.[5,7] And no research has explored its impact on FFHL. This study

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focused on the patients with hyperlipidemia and FFHL admitted to our hospital and selected FFHL patients with normal lipid metabolism as controls to analyze potential factors affecting their prognosis.

Materials and Methods

General Materials

Patients diagnosed with FFHL and accompanied by hyperlipidemia were hospitalized in our department from September 2021 to May 2024 were selected as the hyperlipidemia group, while patients with FFHL and normal lipid indicators during the same period were selected as the control group. Collect general information of patients (Figure 1). All patients received an intravenous infusion of Ginaton (Ginkgo biloba extract, GBE, Chi Sheng Pharma & Biotech Co., Ltd., Hsinchu, Taiwan, China) and Fibrinolysin (Science Sun Pharmaceutical Co., Ltd., Beijing, China) for intravenous drip (IVGTT), with dexamethasone (DXMS, Cisen Pharmaceutical Co., Ltd Jining, Shandong, China) for both intravenous drip and tympanic injection (IT). Patients with hyperlipidemia are treated with corresponding medications such as statins or beta based on the type of lipid metabolism abnormality. This study was reviewed by the Ethics Committee of the Changzhou Third People's Hospital: (02 A-A20230026). As is a retrospective research, written consent was not required by the permission of the ethics committee. Patient data will be strictly kept confidential and supervised by the ethical committee. The guidelines outlined in the Declaration of Helsinki were followed. Patients with hyperlipidemia accepted or rejected lipid lowering therapy by their willingness.

Selection Criteria

1. The hyperlipidemia group met the diagnostic criteria for FFHL and hyperlipidemia, while the control group met the diagnostic criteria for FFHL;
2. Not received any other treatment for hearing loss or hyperlipidemia during the onset;
3. The onset is within 15 days.

Exclusion Criteria

1. Clear causes like trauma, noise, tumors, etc;
2. Unable to cooperate in completing treatment;
3. Accompanied by other underlying diseases.

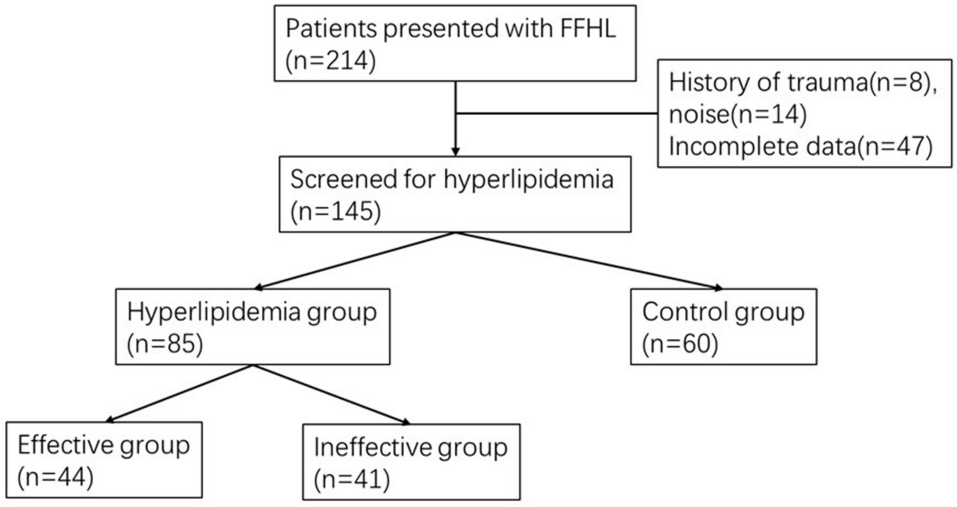

Figure 1 Schematic view of the study workflow.

Inspection Indicators

Hearing Tests

Ear examination, otoscopy, acoustic impedance, otoacoustic emission, auditory brainstem response, and ear magnetic resonance imaging were performed to exclude other factors that might affect hearing. Hearing examinations performed on the same day measured air-conducted and bone-conducted PTA at 0.125 0.25, 0.5, 1, 2, 4, and 8 kHz. The tests were performed by an audiologist in a standardized shielded room. Patients were classified into low-frequency descending (hearing loss at frequencies below 1000 hz with a hearing loss of ≥ 20 dBHL), high-frequency descending (hearing loss at frequencies above 2000 hz with hearing loss of at least 20 dB HL), flat-frequency descending (hearing loss at all frequencies, with an average hearing threshold of ≤ 80 dBHL), and total deafness (decrease in hearing at all frequencies, with an average hearing threshold of ≥ 81 dBHL) groups. The classification criteria were based on the 2015 guidelines. The degree of hearing loss was assessed using the average hearing thresholds (0.25–4 kHz) for the frequencies causing damage in both ears before and after treatment. According to the 1997 WHO classification criteria for hearing impairment, based on the results of pure tone hearing threshold measurements, the pure tone average (PTA) of affected ears at four frequencies (0.5, 1, 2, and 4 kHz) was calculated. The average improvement in the PTA was then calculated. The efficacy evaluation was either deemed effective or ineffective. An average PTA improvement of less than 15 dB compared with the pretreatment hearing threshold was considered ineffective, and ≥15 dB was considered effective.

Blood Lipid Examination

Collect 5 mL of fasting venous blood from patients using anticoagulant tubes in the morning and detect the levels of cholesterol, triglycerides, high-density lipoprotein cholesterol, and low-density lipoprotein cholesterol in patients.

Statistical Methods

Count data is expressed in frequency. The numerical data of normal distribution is represented as mean ± standard error deviation. Based on the data representation, SPSS 20.0 (IBM, Armonk, New York, USA) analyzed the research data with a test criterion of P=0.05. According to the data type, t-test or analysis of variance are performed, Pearson's test is used for correlation analysis, chi-square reduction is used for inter-group comparison, and binary logistic analysis is used to analyze prognostic factors of patients with lipid metabolism abnormalities. The econometric variables are expressed as mean ± standard deviation, P<0.05 is considered statistically significant for the difference.

Results

Basic Information

A total of 85 patients who met the criteria were included in the hyperlipidemia group, and 60 patients were included in the control group. The proportion of males in the hyperlipidemia group is significantly higher than that of the control group. There were no significant difference in other subjects between the two groups, as shown in Table 1.

Correlation Analysis of Hearing Loss Prognosis in Patients with Hyperlipidemia

The hyperlipidemia group was divided into therapeutic groups, with 44 cases in the effective group and 41 cases in the ineffective group. Group tests were conducted on basic information, accompanying symptoms, blood lipid indicators, and other data. The results showed that there was a statistically significant difference in the age and infantry vehicle of the two groups of patients. There was no significant difference in the levels of blood lipid indicators, gender, age, affected side, and tinnitus between the two groups, as shown in the Table 2.

A binary logistic analysis was conducted on the patient's age and course of disease, and the results showed that age and course of disease were independent prognostic factors, as shown in Table 3.

Table 1 Patients Information

	Hyperlipidemia	Control	*P*
Cases	85	60	
Age(years)	55.75±13.15	52.77±16.38	0.244
Gender			
Male	53	27	0.043
Female	32	33	
Onset(days)	4.85±4.06	4.63±4.59	0.768
Side			
Left	42	31	0.867
Right	43	29	
Average hearing threshold			
Pre-treatment	77.12±26.0475.59±29.01	82.75±27.61	0.138
Post-treatment	58.56±27.6456.64±30.73	60.54±35.50	0.481
Effective	44	30	0.867
Accompany symptoms			
Tinnitus	69	53	0.356
Vertigo	25	9	0.044

Table 2 Comparison of Effective and Ineffective Patient Information in the Hyperlipidemia Group

	Effective	Ineffective	*P*
Cases	44	41	
Age(years)	52.21±12.5252.82±12.22	58.86±12.0858.90±13.52	0.032
Gender			
Male	29	24	0.510
Female	15	17	
Onset(days)	3.91±2.893.93±2.97	6.10±4.865.83±4.82	0.030
Side			
Left	24	18	0.388
Right	20	23	
Accompany symptoms			
Tinnitus	37	32	0.582
Vertigo	8	17	0.020
Lipid-lowering treatment	34	29	0.621
Serum lipid parameters			
Cholesterol	5.44±1.285.36±1.21	5.28±1.145.24±1.28	0.655
Triglyceride	3.03±2.252.97±2.51	3.10±2.612.57±2.04	0.427
High-density lipoprotein	1.20±0.431.23±0.44	1.22±0.431.20±0.44	0.811
Low-density lipoprotein	3.46±1.213.25±1.10	3.16±1.053.36±1.15	0.644

Table 3 Analysis of Influencing Factors on Effectiveness

	B	S.E,	Wals	df	Sig.	Exp (B)
Age	−0.042	0.020	4.410	1	0.036	0.959
Onset	−0.134	0.061	4.884	1	0.027	0.875
Vertigo	−1.408	0.555	6.441	1	0.011	0.245

Discussion

The etiology of different types of hearing loss varies and the causes of FFHL are often related to dysfunction of the inner ear vascular microcirculation. Microvascular injury and increased blood viscosity can both lead to cochlear microcirculation disorders, damage cochlear hair cells, and lead to hearing loss.[8,9] Elevated serum lipids can cause an increase in blood viscosity, which in turn can damage hearing.[10] There are reports indicating that lipid-lowering drugs can effectively treat sensorineural hearing loss.[11,12] Studies have also found a correlation between blood lipid profiles and the onset of ISSNHL. So hyperlipidemia can cause vascular lesions and affect circulatory function and maybe a prognostic factor for FFHL.[13] Previous literature has explored the impact of lipid metabolism abnormalities on ISSNHL,[14–16] In these studies, cholesterol, triglycerides, high-density lipoprotein cholesterol, and low-density lipoprotein cholesterol were all considered influencing factors,[17,18] and it is believed that lipid-lowering therapy can improve the prognosis of ISSNHL.[19] But opposing conclusions exists, a meta analysis shows that only high TC level is a risk factor for SSNHL,[7] but Chen[5] believes low-density lipoprotein level is closely associated with hearing recovery. And there is a lack of research on FFHL. Therefore, discussing the relationship between Hyperlipidemia and FFHL has a certain meaning.

In this study, it was found that for patients with FFHL, the proportion of males in the hyperlipidemia group was significantly higher than that of the control group. This may be related to differences in lifestyle habits between males and females, which needs further discussion, a study has also found that ISSNHL in patients with metabolic syndrome is more common in males than females.[20] The probability of vertigo in the hyperlipidemia group is higher than in the control group. ISSNHL accompanied by vertigo may be caused by vascular embolism and inner ear bleeding, the blood supply to the vestibule mainly comes from the vestibular anterior artery and vestibular cochlear artery, both of which are terminal branches.[21,22] When blood lipids rise and cause vascular obstruction, there is no collateral circulation supply, leading to vestibular ischemia and vestibular dysfunction.[23] There was no significant difference in other subjects between patients with hyperlipidemia and those with normal metabolism. A previous meta-analysis also reached a similar conclusion.[24]

For the hyperlipidemia group, age, onset, and vertigo may be factors that affect their prognosis. Those who are older and have a longer onset accompanied by vertigo have a poorer prognosis, which is similar to former studies.[25] The influence of age and onset time is clear,[26–28] but some studies suggest that no significant relationship exists between the prognosis of vertigo and ISSNHL.[29] Various serum lipid indicators and lipid lowering treatments have no significant effect on recovery. The impact of hyperlipidemia on FFHL is limited, which deviates from previous research findings and may be related to sample size. This study also did not follow up on the blood lipid levels of patients after lipid-lowering treatment. However, some studies suggest that there is insufficient evidence to prove the association between hyperlipidemia and sudden sensorineural hearing loss.[22] High-quality research is still needed to prove the conclusion.

Conclusion

The proportion of males and vertigo in FFHL patients accompanied with hyperlipidemia is higher than that of patients with normal serum lipids. The prognosis of FFHL patients with hyperlipidemia is related to their age, onset, and vertigo, which are independent factors affecting the prognosis of hyperlipidemia FFHL patients, an elderly, long-onset, and vertigo patient may receive a poor prognosis. Various lipid indicators have no significant impact on the prognosis.

Disclosure

The author(s) report no conflicts of interest in this work.

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