

## Lipid Profile in Patients with Idiopathic Sudden Sensorineural Hearing Loss

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### Abstract

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**Background:** Sudden sensorineural hearing loss is an emergency condition requiring immediate diagnosis and treatment. There are several theories explaining pathogenesis of it. Some of them including vascular disease, viral infection, metabolic disease, autoimmunity, trauma and combinations of multiple factors are suggested to be the causes of it. **Purpose:** This study attempted to detect correlation between dyslipidemia and occurrence of Idiopathic sudden sensorineural hearing loss. **Materials and methods:** This study was a cross sectional that included patients attended to Audiology Unit in Hospital of Benha University in the period from January to November 2021 and diagnosed as having SSNHL within one week, radiological and laboratory studies were done to those patients. **Results:** One hundred and forty-seven patients diagnosed as having idiopathic sudden sensorineural hearing loss. Forty-one of them were excluded and the remaining 106 had laboratory studies (lipid profile) with the following results: 58 patients (54.7%) had increased level of total cholesterol, 61 patients (57.5%) with decreased high density lipoprotein, and 64 patients (60.3%) with elevated low density lipoprotein. **Conclusions:** The study concluded that dyslipidemia represents risk factor for occurrence of sudden sensorineural hearing loss.

**Key words:**Hyperlipidemia, sudden, sensorineural hearing loss, Idiopathic, cholesterol.

## **Introduction:**

Sudden hearing loss (SHL) is a frightening symptom that often prompts an urgent or emergent visit to health care physician[1]. It is defined as a rapid onset subjective sensation of hearing impairment in one or both ears. SHL may be a conductive, sensorineural, or mixed, defined as both conductive and sensorineural occurring in the same side[2].

Sudden sensorineural hearing loss (SSNHL) defined as a 30 dB or greater over at least three consecutive frequencies occurring within 72 hours. Because, pre-morbid audiometry is generally unavailable, HL often defined in relation to the opposite ear's thresholds [3].

Idiopathic sudden sensorineural hearing loss (ISSNHL) defined as SSNHL with no identifiable cause despite adequate investigation. That is the situation in 90% of patients with SSNHL [2].

ISSNHL is an emergency condition for immediate diagnosis and treatment. There are several theories explaining pathogenesis of ISSNHL among which are vascular disease, viral infection, metabolic disease, autoimmunity or combinations of multiple

factors. Recently, microcirculation disturbance hypothesized as the main etiology [4].

The vascular theory based on the fact that cochlea is a target organ with high metabolic demands and its blood supply has no collateral making cochlea high susceptible to compromised blood circulation. Any pathology disturbs arterial circulation that directly supplies the cochlea, such as that caused by atherosclerosis, diabetes mellitus, hyperlipidemia and hypertension, may be risk factor for SSNHL [5].

Hypercholesterolemia and hyperfibrinogenemia are observed frequently in patients with ISSNHL [6]. Moreover, some studies attributed direct correlation between hyperlipidemia and ISSNHL[7].

This study aimed to find correlation between hyperlipidemia and ISSNHL, hoping, for recovery of hearing in such patients with ISSNHL through management of dyslipidemia. The scope of this study is analysis of lipid profile of patients diagnosed as having ISSNHL.

## **Materials and Methods:**

### **Participants**

This study, included subjects of both sexes attended to audiology unit in Hospital of Benha University in the period from (January to November) 2021 and suffering of sudden diminution of hearing within one week with no previous medical treatment for it or were diagnosed as having SSNHL (as a 30 dB or greater over at least three consecutive frequencies occurring within 72 hours [3]. Exclusion criteria included the following: those with recent upper respiratory tract infection, noise induced hearing loss, patients using ototoxic drugs, patients with ear discharge, hearing loss due to causes like Meniere disease, otitis media, otosclerosis and also patients with chronic renal failure excluded from the study.

The study was done in accordance with the ethical principles and approved by Faculty of Medicine, Benha University.

### **Instruments**

Richter otoscope for otoscopic examination, Immittancemetry Interacoustics model AT235H, two channel audiometer, Interacoustics, model AC40.

## **Methods**

This study was a cross sectional that included patients with the above-mentioned criteria who were referred to audiology unit of Hospital of Benha University in the period from January to November 2021. Full medical history including personal data, present, past and family history was taken from those patients. Otoscopic examination, immittancemetry and pure tone audiometry was done. Imaging studies including computed tomography and magnetic resonance imaging was done. Lipid profile was done; low density lipoprotein (LDL), high density lipoprotein (HDL), total cholesterol (TC) level was done to those patients with normal reference values (Table, 1).

Evaluation of hearing was done by the same audiologist and by the same device. Air bone conduction and speech audiometry was assessed. Degree of HL was calculated as the average of air conduction threshold at 0.5, 1, 2 and 4 KHz [8]. Level of HL was classified into 5 grades according to the degree of HL as following: mild (26-40dBHL), moderate (41-55dBHL), moderate to severe (56-70 dB HL), severe (71-90 dB HL), and profound (>90 dB HL) [9]. Pattern of audiogram was classified into

5 types; ascending (the average threshold of 0.25-0.5 KHz was 20 dB higher than that of 4-8 KHz), descending (the average threshold of 4-8 KHz was 20 dB higher than that of 0.25-0.5 KHz), flat (all frequencies present similar thresholds and hearing threshold was below 80dB HL), profound (all frequencies present similar thresholds and hearing threshold was over 80dB HL), and convex type (average hearing degree of the mid tone frequency was 20 dB higher or lower than low and high frequencies) [10].

### **Data analysis**

Data management and statistical analysis was done using SPSS version 25 (IBM, Armonk, New York, United States). Categorical data presented as numbers and percentages. Cholesterol, LDL, and HDL levels were compared between both groups using Fisher's exact test. Correlation analyses were done using Spearman's correlation. All statistical tests were two-sided. P values less than 0.05 were considered significant.

### **Results**

The current study enrolled 147 patients; all of them had imaging studies. Forty-one of them were excluded from the study due to the following reasons: retrocochlear lesions, congenital anomalies or had no complete

medical records. MRI results of the remaining 106 were normal except for old slight ischemia seen in 26 patients who were over 55 years old. Twenty-four of them (22.6%) had hypertension, twelve had diabetes mellitus (11.3%) and five of them (4.7%) were suffering from both hypertension and diabetes mellitus.

As regards demographic data of those patients; 47 were males (44.3%) and 59 were females (55.7%). Age of patients was between 7-78 years. About one third of the patients (31%) were in the fifth decade of life, followed by cases between 51 to 60 years old as they represent 26.4% then cases from 31 to 40 years (18%), then those from 18 to 30 years (14%), those >60 years (8.4%) and lastly less than two percent of cases were below 18 years old (Figure 1).

Hearing loss in all cases was unilateral. Degree of HL was classified into five categories. Figure 2 showed that, the most common category among our patients were those with profound degree (33.9%) followed by severe (29.2%), moderate to severe (23.6%), moderate (10.3%) then mild (2.8%). Moreover, table (2), showed that, there was no significant correlation between severity of HL and dyslipidemia.

Regarding pattern of audiogram it was as following: profound pattern was the most common (45%) followed by flat type (36.8%), the descending type (14%), while, ascending, concave and convex types represented less than 5%. Figure 3 illustrates audiogram flat pattern to one of cases in the study.

According to lipid profile, 58 patients (54.7%) had increased level of TC, 61 patients (57.5%) had decreased HDL, and 64 patients (60.3%) had elevated LDL. Figure 4 illustrate distribution of results of lipid profile according to age.

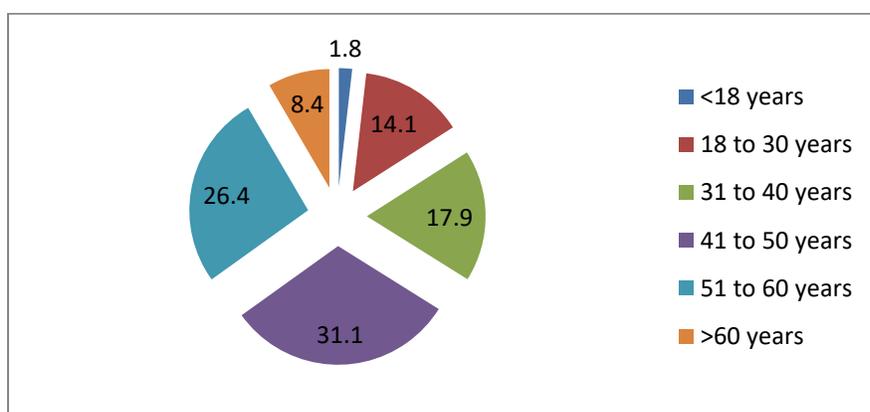
**Table (1):** illustrates lipid profile and its normal reference value

Lipid profile	Normal reference values
<b>Total cholesterol (TC)</b>	<5.16 mmol/L
<b>High density lipoprotein (HDL)</b>	Male: 1.16-1.42 mmol/L Female: 1.29-1.55 mmol/L
<b>Low density lipoprotein (LDL)</b>	<3.1 mmol/L

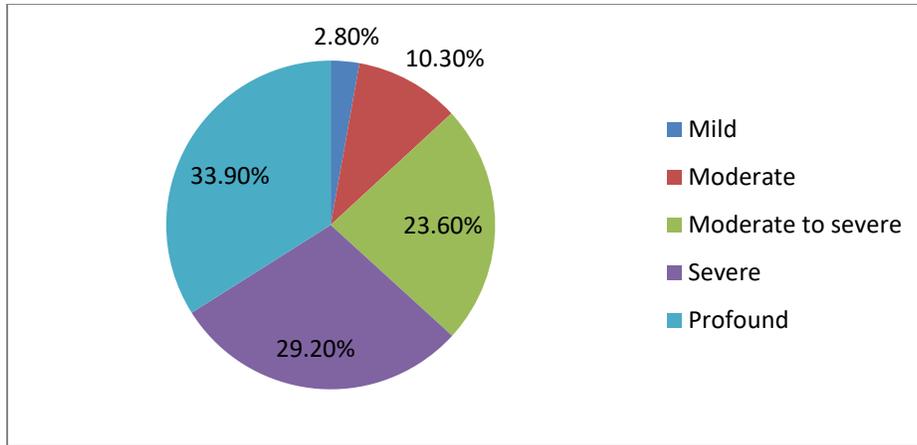
**Table (2):** Distribution of lipid profile according to degree of hearing loss

	Mild HL N= 3	Moderate HL N=11	Moderate to severe HL N=25	Severe HL N=31	Profound HL N=36	P value
High TC	1(33.3)	5 (45.4)	13 (52)	16 (51.6)	23 (63.8)	0.929
Low HDL	1(33.3)	4 (36.4)	14 (56)	17 (54.8)	25 (69.4)	0.081
High LDL	1(33.3)	4 (36.4)	15 (60)	16 (51.6)	28 (77.7)	0.319

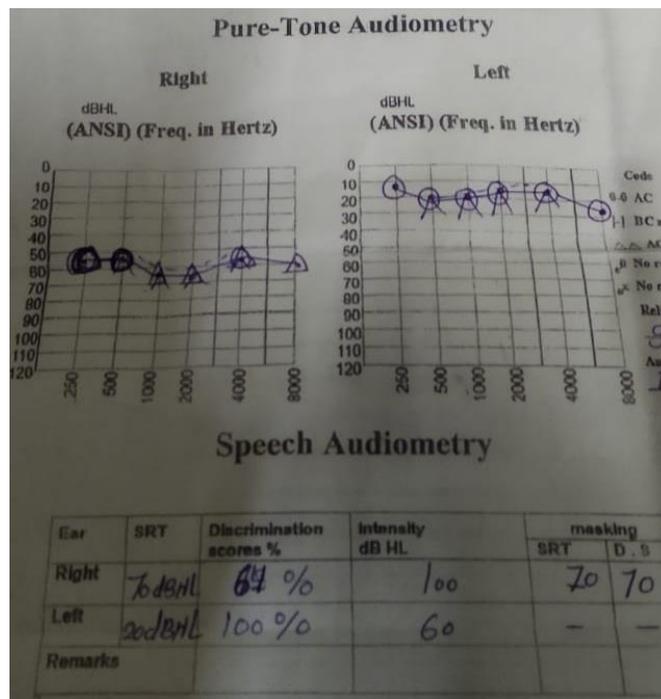
Spearman's correlation was used



**Fig. (1):** Age distribution of the study group



**Fig.(2):** Degree of hearing loss in the study group.



**Fig. (3):** Audiogram with flat pattern of one of patients included in the study. This was audiogram of one of the cases included in the study with right moderately severe SNHL which was diagnosed as ISSNHL.

## Discussion

SSNHL is a common complaint in otologic and audiologic practices. The pathogenesis of idiopathic SSNHL remains unclear.

Several theories proposed for the possible underlying mechanisms of the disease, such as viral infection, intracochlear membrane

rupture, and vascular compromise (local ischemia reperfusion). There are only a limited number of high evidence level clinical trials to prove the efficiency of each treatment for idiopathic SSNHL [11].

Several studies tried to analyze the possible correlation between hearing loss and lipid profile levels. Vascular events, immunological processes and viral infections were considered as pathomechanisms for most cases of SSNHL. Heparin-induced extracorporeal LDL precipitation apheresis which acutely and drastically reduces LDL, fibrinogen and lipoprotein reported in the treatment of patients suffering from SSNHL [12].

Hyperlipidemia is an increase in one or more of the plasma lipids, including triglycerides, cholesterol, cholesterol esters, phospholipids and plasma lipoproteins including low density lipoprotein, and reduced high density lipoprotein levels [13].

A lot of studies were done to demonstrate the relation between serum lipid profiles and ISSNHL, contra directory results. Findings from these studies was inconsistent, as some suggested, a possible association between serum lipids and SSNHL, while, others disputed such an association [14 & 15].

The present study was designed to evaluate lipid profile in patients with ISSNHL hoping to find correlation between dyslipidemia and occurrence of ISSNHL.

As regards demographic data, there was slight preponderance of females (55.6%) in our study. This was different from other studies [16 & 4], where the prior study demonstrated similar numbers of both sexes while, the latter showed a slight preponderance of males.

In the present study, the age groups ranging from 41 to 50 years and from 51 to 60 years represented 57% of participants, and this was similar to a study done in 2008 [17] on cases with ISSNHL.

Sudden sensorineural hearing loss is almost always unilateral [18]. All cases in this study was unilateral, other studies as that done in 2020, which showed less than two in percent of cases with bilateral SSNHL [4].

According to audiogram pattern in the current study, profound type was the most common (45%), followed by flat type (36.8%), the descending type (14%), while, the ascending, and convex types represented less than 5%. In 2021 similar results were gained, where ascending pattern was detected in (21.2%) followed by, descending

pattern (28.0%), flat pattern (25.3%) and profound pattern (25.5%) [19].

As regards to lipid profile, 58 patients (54.7%) had increased level of TC, 61 patients (57.5%) with decreased HDL, and 64 patients (60.3%) with elevated LDL. On comparing with other studies, it was found that the concentrations of total cholesterol, triglyceride, and lipoprotein were significantly higher in patients with SSNHL compared to controls [14]. Also, others reported only higher concentrations of cholesterol and LDL in patients with SSNHL [15]. In 2015, a study was conducted involving 94 ISSNHL patients and declared that total cholesterol concentrations might be a prognostic factor for recovery in ISSHL and correlated with poorer hearing recovery [6]. A case controlled study done in Iraq [20] found significant difference between the means of lipid profile and blood sugar of the patients with SSNHL and the control group apart from HDL where there was no significant difference.

### **Limitations**

The present study had no control group for comparison lipid profile between both groups. Also, we did not assess hearing

recovery with management of hyperlipidemia.

### **Conclusions**

This study concludes that dyslipidemia represents major risk factor for occurrence of SSNHL. Further studies should be done to confirm that conclusion and also trial treatment of SSNHL through management of dyslipidemia.

### **References**

- 1- Dallan I, Fortunato S, and Casanr AP. Long term follow up of sudden sensorineural hearing loss patients treated with intratympanic steroids: Audiological and quality of life evaluation. *J Laryngol Otol.* 2014; 128: 669-673.
- 2- Chandrasekhar SS, Tsai Do BS, Schawartz SR, Bontempo LJ, Finestone SA, Hollingsworth DB et al., Clinical practice guideline: Sudden hearing loss (update). *Otolaryngol Head Neck Surg.*2019; 161(1): S1-S45.
- 3- Wilson WR, Byl FM, and Laird N. The efficacy of steroids in the treatment of idiopathic sudden hearing loss, a double blind clinical study. *Acta Oto Laryngologica.* 1980; 106: 772-776.
- 4- Xie W, Dai Q, Liu J, Hellstrom S, and Duan M. Analysis of clinical and laboratory findings of idiopathic sudden sensorineural hearing loss. *Scientific Reports.* 2020; 10: 6057.
- 5- Khater A, Elanwa M, Nofal A, and Elbahrawy A. Sudden sensorineural hearing loss: Comparative study of different treatment modalities. *IntArachOtorhinolaryngol.* 2018; 22(3): 245-249.

- 6- Quaranta N, Squeo V, Sangieto M, Graziano G, and Sabba C. High total cholesterol in peripheral blood correlates with poorer hearing recovery in idiopathic sudden sensorineural hearing loss. *Plos One*. 2015; 10(7): e 0133300.
- 7- Chang S, Hsieh C, Tseng K, and Weng S. Hypercholesterolemia is correlated with an increased risk of idiopathic sudden sensorineural hearing loss: A historical prospective cohort study. *Ear and Hearing*. 2013; 35(2).
- 8- Fasano T. Laboratory assessment of sudden sensorineural hearing loss: A case control study. *Laryngoscope*. 2017; 127: 2375-2381.
- 9- Clark JG. Uses and abuses of hearing loss classification. *ASHA*. 1981; 23: 493-500.
- 10- Editorial Board of Chinese Otorhinolaryngology Head and neck Surgery; Society of Otorhinolaryngology Head and neck Surgery, Chinese Medical Association. Guideline of diagnosis and treatment of sudden deafness. *Chinese Journal of Otorhinolaryngology Head and Neck Surgery*. 2015; 50: 443-447.
- 11- LarwrenceR, and Therasagayam R. Controversies in the management of sudden sensorineural hearing loss: an evidence based review. *ClinOtolaryngolo*. 2015; 40: 176-182.
- 12- AxelssonA, and Lindgren. Is there a relationship between hypercholesterolemia and noise induced hearing loss? *ActaOtolarynogol*. 1985; 100(5-6): 379-386.
- 13- Mishra PR, Pand PK, Apanna KC, and Panigrahi S. Evaluation of acute hypolipidemic activity of different plant extracts in Triton WR-1339 induced hyperlipidemia in albino rats. *Pharmacology on line*. 2011; 3: 925-934.
- 14- Lu YY, Jin Z, Tong BS, Yang JM, Liu YH, and Duan M. A clinical study of microcirculatory disturbance in Chinese patients with sudden deafness. *ActaOtolaryngol*. 2008; 128: 1168-1172.
- 15- Oreskovic Z, Shejbal D, Biconic G, and Kekic B. Influence of lipoproteins and fibrinogen on pathogenesis of sudden sensorineural hearing loss. *J Laryngol Otol*. 2011; 125: 258-261.
- 16- Fetterman BL, Luxford WM, and Saunders JE. Sudden bilateral sensorineural hearing loss. *Laryngoscope*. 1996; 106(11): 1347.
- 17- Rauch SD. Clinical practice. Idiopathic sudden sensorineural hearing loss. *N Engl J Med*. 2008; 359(8): 833.
- 18- Weber PC. Sudden sensorineural hearing loss: evaluation and management. <http://www.up to date sudden sensorineural hearing loss in adults evaluation and management>; 2022.
- 19- Zhang J, Ji S, Ma X, Yu L, and Jing Y. Association between meteorological factors and audiogram configurations in patients with sudden sensorineural hearing loss: A cross sectional study. *BMJ*. 2021; 11: eD45768.
- 20- Muttalib Mohammed AA. Lipid profile among patients with sudden sensorineural hearing loss. *Indian J Otolaryngol Head and neck surg*. 2014; 66(4): 425-428.

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