

Significance of Blood Tests in Diagnosing Idiopathic Unilateral Sensorineural Hearing Loss

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Abstract:

Idiopathic sensorineural hearing loss accounts for the majority of cases. As a result, the outcome is determined by variables related to the type of disease and its management. These may come on suddenly or gradually. Many research are conducted to assess the correlation in abrupt diversity; however, there is still insufficient data to support causality. Studies on increasing variety and its effects are scarce. A prospective study was conducted on forty individuals with idiopathic unilateral SNHL in an effort to determine the parameters linked to the prognosis or severity of the disease. A strong correlation was discovered between distribution of random blood sugar and post therapy improvement in patients. There was no discernible correlation between the severity of progressive SNHL and any blood parameter, nor between other blood parameters and treatment outcome in abrupt SNHL. In unilateral ISSNHL, elevated blood sugar may have a detrimental impact on treatment success. Scientific research on "Unilateral Idiopathic Progressive Sensorineural Hearing Loss" shows little evidence of a connection or link with the illness's etiology.

Keywords: Unilateral hearing loss · Sensorineural hearing loss · Prognosis.

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Introduction

Unilateral Idiopathic sudden sensorineural hearing loss (ISSNHL) is commonly defined as sensorineural hearing loss (SNHL) in one ear, with other ear being normal and no identifiable cause attributed to SNHL. It can be sudden or progressive. Sudden SNHL is defined as hearing loss of 30 decibel (dB) or more over a period of 3 days in 3 consecutive frequencies [1]. It is seen that a cause is identified in only 10% of sudden SNHL [2]. Hence, more focus goes on identifying the prognostic factors to treat it or factors affecting nature of disease.

Various mechanisms have been proposed for idiopathic sudden SNHL like viral, immune mediated, trauma, inflammation, vascular disturbances, etc. which may contribute to cochlear damage [2]. Progressive SNHL can be divided as rapidly progressive (between 3 to 90 days) and slowly progressive or juvenile (starts after birth) and adult (onset after 40 years of age) [3, 4]. Limited studies have been done for unilateral idiopathic progressive sensorineural hearing loss (IPSNHL).

Material and Methods

A prospective study was carried out with 40 patients of idiopathic Unilateral Sensorineural Hearing Loss (USNHL), based on pure tone audiometry, in the department of Otorhinolaryngology. Patients

were divided into two groups, based on onset and progression of hearing loss. MRI was done in all patients to rule out retro-cochlear pathology. Blood investigation like complete blood counts, serum thyroid stimulating hormone, serum urea and creatinine, lipid profile and antinuclear antibodies were evaluated.

Unilateral ISSNHL was treated using oral corticosteroids (prednisolone 1 mg/kg body weight in the tapering dose for two weeks), and improvement was assessed using Siegel's criteria. We also studied any association of different blood parameters between patients who showed improvement/no improvement post-treatment. Standard reference value were taken for each blood parameter and reference value for Neutrophil-lymphocyte ratio and lymphocyte-monocyte ratio were taken as 1.65 ± 0.79 and 5.31 ± 1.68 , respectively [5]. Unilateral IPSNHL was again divided between five groups depending upon severity of hearing loss and different blood parameters were studied for association with these groups.

Statistical Analysis: Quantitative data was expressed as median or mean. Categorical binary data were analysed using Fisher's exact test or Chi-square test.

Results

Out of 40 patients, 12 patients (30%) were evaluated as unilateral ISSNHL and 28 (70%) patients were evaluated as unilateral IPSNHL.

Unilateral Idiopathic Sudden Sensory Neural Hearing Loss (ISSNHL) Group Analysis:

Twelve patients diagnosed as ISSNHL were studied. Majority belonged to age group 31–40 years with 66% male predominance. 59% had left ear involvement. Using Siegel's criteria, 58.34% of patients had hearing improvement following treatment. Recovery was complete in 16.6%, partial in 33.3%, slight in 8.4% and no recovery in 41.2%. There was a significant difference between post-treatment improvement and associated factor (Tinnitus/ vertigo/both/none) ($p = 0.047$). There was a significant difference between severity of hearing loss (dB) and post-treatment improvement (dB) ($p = 0.002$), with the median severity of hearing loss being highest in the no improvement group. Blood parameters were categorized into groups with normal and abnormal values and compared with presence or absence of improvement (Table 1).

Fisher's exact test was used to explore the association between 'post-treatment improvement' and 'random blood sugar'. There was a significant difference seen between the various groups in terms of distribution of random blood sugar and post treatment improvement ($p = 0.045$) (Fig. 1). There was no significant difference seen in the group with and

without improvement concerning gender, duration, and other laboratory investigations like haemoglobin, total leucocyte counts, neutrophils, lymphocytes, eosinophils, monocytes, serum thyroid stimulating hormone, serum urea, serum creatinine, serum total cholesterol, serum triglyceride, serum high density lipoprotein, serum low density lipoprotein, neutrophil: lymphocyte and lymphocyte: monocyte ratio.

Unilateral Idiopathic Progressive Sensory Neural Hearing Loss [IPSNHL] Patients Group Analysis:

28 patients with IPSNHL were evaluated. There was a male predominance seen (78.6%) with majority being below 30 years of age (39.3%). Right and left ear involvement was almost similar. Majority had duration of illness between 1 to 5 years. 42% had profound hearing loss and 25% had associated tinnitus. Association was studied between groups (a) varying degree of severity of hearing loss, (b) laboratory parameters categorized into normal and abnormal values. There was no statistically significant association seen between severity of hearing loss group and features like gender, tinnitus/vertigo and other laboratory investigations like haemoglobin, total leucocyte counts, neutrophils, lymphocytes, eosinophils, monocytes, serum thyroid stimulating hormone, serum urea, serum creatinine, serum total cholesterol, serum triglyceride, serum high density lipoprotein and serum low density lipoprotein (Table 2).

Table 1: Association between pre and post-treatment improvement in blood parameters

Parameters	Parameters	Post-treatment improvement: present (n = 7)	Post-treatment improvement: absent (n = 5)	p value
Haemoglobin	\ 12 gm/dL	1	0	1
	C 12 gm/dL	6	5	
Total leucocyte counts	\ 4000/cu.mm or [10,000/cu.mm	0	1	0.416
	4000–10,000/cu.mm	7	4	
Neutrophils	\ 55% or [70%	2	3	0.558
	55–70%	5	2	
Lymphocytes	\ 15% or [40%	0	2	0.152
	15–40%	7	3	
Eosinophils	B 4%	6	4	1
	> 4%	1	1	
Monocytes	B 6%	2	3	0.558
	> 6%	5	2	
Serum thyroid stimulating hormone	\ 0.5 mIU/L or [5.5mIU/L	0	0	1
	L	7	5	
Serum urea	\ 40 mg/dL	0	0	1
	> 40 mg/dL	7	5	
Serum creatinine	\ 1.1 mg/dL	6	4	1
	> 1.1 mg/dL	1	1	
Serum total cholesterol	\ 200 mg/dL	3	4	0.292

	> 200 mg/dL	4	1	
Serum triglyceride	\ 150 mg/dL	5	5	0.469
	> 150 mg/dL	2	0	
Serum high density lipoprotein	\ 40 mg/dL	0	1	0.417
	> 40 mg/dL	7	4	
Serum low density lipoprotein	\ 100 mg/dL	0	0	1
	> 100 mg/dL	7	5	
Random blood sugar	\ 140 mg/dL	7	2	0.045
	> 140 mg/dL	0	3	
Neutrophil: lymphocyte	(0.86–2.44)	4	2	1
	\ 0.86 or [2.44	3	3	
Lymphocyte: monocyte	3.63–6.99	2	2	1
	\ 3.63 or [6.99	5	3	

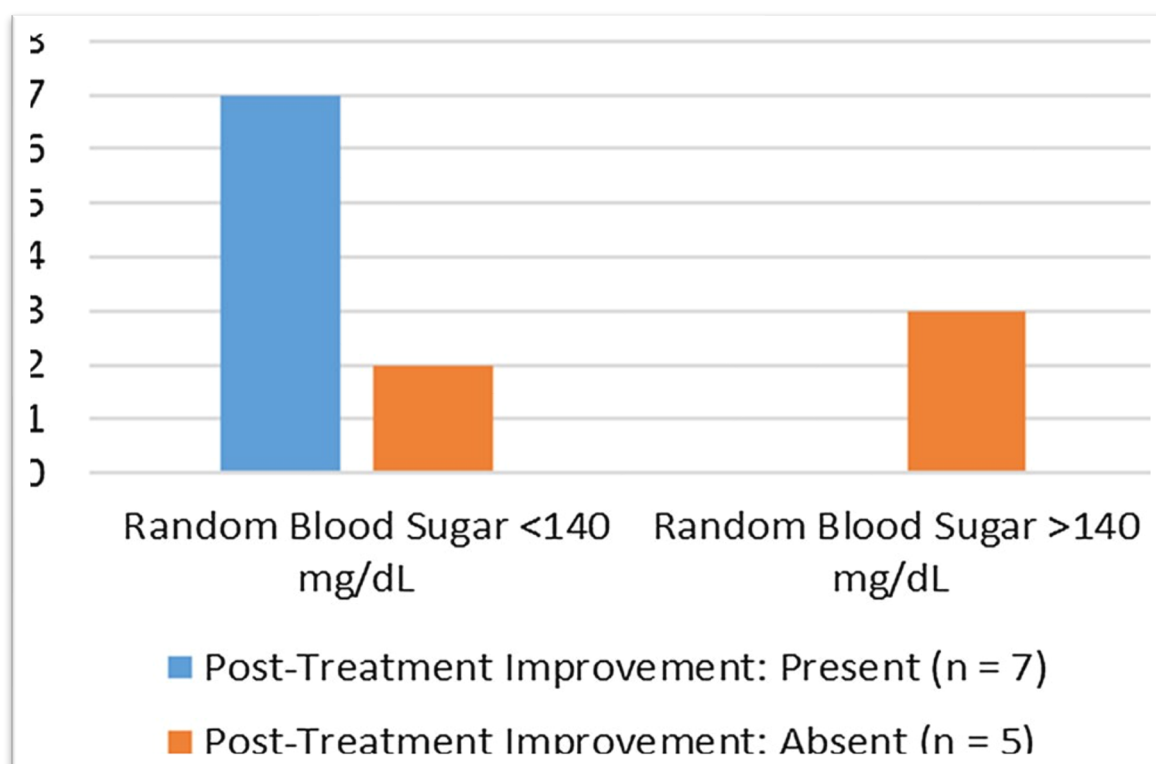


Figure 1: Bar depicting improvement in hearing and the presence of raised blood sugar levels

Table 2: Association between profound hearing loss and parameters in patients with IPSNHL

Parameters	Hearing loss	Mild	Moderate	Moderate-severe	Severe	Profound	p value
Haemoglobin	\ 12 gm/dL	1	0	1	0	1	0.221
	C 12 gm/dL	4	3	1	6	11	
Total leucocyte counts	\ 4000/cu.mm or [10,000/cu.mm	1	0	1	0	0	0.079
	4000–10,000/cu.mm	4	3	1	6	12	
Neutrophils	\ 55% or [70%	2	0	1	2	5	0.122
	55–70%	3	3	1	4	7	
Lymphocytes	\ 15% or [40%	0	0	0	0	3	0.668
	15–40%	5	3	2	6	9	

Eosinophils	B 4%	4	3	1	4	4	0.177
	> 4%	1	0	1	2	8	
Monocytes	B 6%	3	1	1	2	5	0.941
	> 6%	2	2	1	4	7	
Serum thyroid stimulating hormone	\ 0.5 mIU/L or [5.5mIU/L	0	1	0	0	2	0.535
	0.5–5.5 mIU/L	5	2	2	6	10	
Serum urea	\ 40 mg/dL	5	2	2	5	11	0.601
	> 40 mg/dL	0	1	0	1	1	
Serum creatinine	\ 1.1 mg/dL	3	3	0	4	11	0.043
	> 1.1 mg/dL	2	0	2	2	1	
Serum total cholesterol	\ 200 mg/dL	4	2	2	5	4	0.143
	> 200 mg/dL	1	1	0	1	8	
Serum triglyceride	\ 150 mg/dL	4	0	1	4	3	0.078
	> 150 mg/dL	1	3	1	2	9	
Serum high density lipoprotein	\ 40 mg/dL	2	1	0	2	2	0.767
	> 40 mg/dL	3	2	2	4	10	
Serum low density lipoprotein	\ 100 mg/dL	1	1	1	3	5	0.939
	> 100 mg/dL	4	2	1	3	7	
Random blood sugar	\ 140 mg/dL	4	3	2	6	12	0.357
	> 140 mg/dL	1	0	0	0	0	

Discussion

A large array of investigations is required to state USNHL as idiopathic. It includes serological tests for syphilis, antiphospholipid antibody, C - reactive protein, ESR, anti- Ro, anticardiolipin, anti-B2-glycoprotein1, etc. for exclusion along with clinical analogy [3,4]. Both mechanism of cochlear damage and vascular insult are possible causes of idiopathic sudden USNHL [4].

In our study, 12 patients with ISSNHL were treated using oral corticosteroids, and 58.34% of them showed improvement based on Siegel's criteria. On further evaluation between post-treatment patients with and without improvement, it was found that tinnitus/vertigo, severity of hearing loss, and blood sugar had a significant association. Elevated blood sugar levels were seen in large proportion in no improvement group. Similar findings were also seen by Fasano et al., Voelker et al. and Wang et al. [1,6,7]. This might be due to diabetes causing neuropathy and angiopathy, directly interfering with cochlear blood supply and reducing nutrient transportation leading demyelination, an early injury to peripheral nerves [8].

Tinnitus was found to be significantly associated with ISSNHL in our study (tinnitus seen in large proportion in the improved group), similar to Chiossoine-Kerdel et al. and vice-versa to Nogueira-Neto et al. who found that worse initial hearing had more tinnitus and hence more cochlear damage [9]. Though the metabolism of glucose is responsible for inner ear diseases, the role of dyslipidaemia remains quite vague [10]. The role of dyslipidaemia has been quite variable in previous

studies regarding the prediction of hearing recovery in ISSNHL. Dyslipidaemia was not found to be significantly associated with ISSNHL in our study as well as in a systematic review and meta-analysis by Chang et al., however significant association was seen between hearing loss and levels of (a) lipoprotein a, by Fasano et al. (b) triglyceride, total cholesterol and LDL, by Mohammed et al. and, (c) Apolipoprotein-A&B, by Kaneva et al. [1,2,10].

Age, gender, and blood counts were also found to be non-significant in our study, however Chen et al. and Sato et al. found otherwise [11, 12]. Possible mechanism for dyslipidaemia contributing to ISSNHL could be either a prothrombotic effect or accelerated atherogenesis in intima of blood vessels, thereby leading hyper viscosity and decreased blood flow for cochlear metabolism [1].

NLR is an easily measured, widely available biomarker of inflammation. NLR is associated with pathogenesis and recovery of idiopathic sudden SNHL. In our study, neutrophil to lymphocyte ratio and lymphocyte to monocyte ratio was not found to be associated with ISSNHL recovery, whereas it was relatively higher in patients having less recovery in one study [12].

As cochlea blood supply is based on terminal labyrinthine artery, hence chronic inflammation directly increases the likelihood of ischemia, and a plausible way to SNHL [12]. Though a positive association is seen between sudden USNHL and stroke, risk factors for atherosclerosis are as common in patients as in normal [4]. Steroid regime (oral prednisolone 1 mg/kg in a tapering dose) is recommended and intratympanic steroid is

considered for patients with risk to oral steroid or refractory to it [4].

Rapidly progressive SNHL is different from sudden SNHL with regards to longer time of recovery and being more bilateral [13]. There is variation in its definition which varies with number of days taken to develop [13]. Most of progressive hearing loss is thought due to cochlear damage, both in children and adults [13, 14]. Progressive SNHL must be differentiated from immune mediated SNHL (immune mediated is responsive to steroid) [15].

In our study, progressive SNHL was found to be more common than sudden whereas George et al. found sudden variety more common [4]. In our study of 28 patients with unilateral IPSNHL, there was no statistically significant association seen among gender, clinical features, associated features, and laboratory investigations (haemoglobin, total leucocyte counts, neutrophils, lymphocytes, eosinophils, monocytes, serum thyroid stimulating hormone, serum urea, serum creatinine, serum total cholesterol, serum triglyceride, serum high density lipoprotein, serum low density lipoprotein) with the severity of hearing loss.

In a study by Berrettini et al. in 1998, they concluded that a detailed medical and family history with audiological, neurotological, neuroradiological, ophthalmological, and rheumatological workup is required to establish an etiology or conclude idiopathic [16]. Based on this, there were limited tools of evaluation in our study regarding IPSNHL and need studies with large sample size to add evidence to such associations.

Key message Using haematological and biochemical assay (serum thyroid stimulating hormone, serum urea, serum creatinine, lipid profile), no association was seen between nature of disease for idiopathic USNHL, both sudden and progressive. Raised blood sugar levels were significantly associated with poor prognosis in sudden variety, while no such association seen with progressive SNHL.

Tinnitus, vertigo and profound hearing loss were also significantly associated with sudden SNHL. Majority of ISSNHL can be treated effectively with early diagnosis, hence early identification of such factors will help in assessing severity and improving outcome of disease.

No significant associated factor can be found with idiopathic progressive USNHL.

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