

# Audiological Assessment and Rehabilitation Considerations in Unilateral Sudden Sensorineural Hearing Loss Accompanied by Refractory Tinnitus: A Case Report

Mohammad Hossein Nilforoush<sup>1</sup>  

## Case Report

### Abstract

**Introduction:** Unilateral sudden sensorineural hearing loss (SSNHL) accompanied by tinnitus is an audiological emergency that can lead to permanent auditory, perceptual, and psychological sequelae.

**Case Report:** A 45-year-old man presented to the audiology clinic within 24 hours of symptom onset, complaining of sudden-onset hearing loss and persistent tinnitus in the left ear. The comprehensive audiological evaluation – including pure-tone audiometry, speech audiometry, tympanometry, and acoustic reflex testing – revealed a unilateral severe-to-profound sensorineural hearing loss and high-intensity continuous tinnitus. At the same time, the contralateral ear remained within normal limits. The patient received medical treatment consisting of systemic corticosteroid therapy, combined with counseling and audiological rehabilitation (tinnitus counseling and the fitting of a unilateral hearing aid equipped with a tinnitus masker).

**Conclusion:** At the three-month follow-up, a partial recovery of hearing thresholds at speech frequencies and a significant reduction in tinnitus intensity and distress were observed. However, the residual hearing loss remained severe. This case underscores the critical importance of prompt referral, comprehensive audiological assessment, and the implementation of a multidimensional rehabilitation program for the concurrent management of sudden hearing loss and tinnitus.

**Keywords:** Sudden sensorineural hearing loss; Tinnitus; Hearing aids; Auditory rehabilitation; Case report

**Citation:** Nilforoush MH. **Audiological Assessment and Rehabilitation Considerations in Unilateral Sudden Sensorineural Hearing Loss Accompanied by Refractory Tinnitus: A Case Report.** *J Res Rehabil Sci* 2023; 19.

Received date: 30.01.2023

Accept date: 11.03.2023

Published: 04.04.2023

### Introduction

Sudden sensorineural hearing loss (SSNHL) is clinically defined as a rapid decline in hearing of at least 30 dB across three consecutive frequencies within 72 hours, and it is predominantly unilateral (1). While the etiology remains idiopathic in many cases, various factors—including viral infections, vascular compromise, autoimmune disorders, and microcirculatory disturbances—have been implicated in its pathogenesis (2). SSNHL is frequently accompanied by symptoms such as aural fullness, vertigo, and tinnitus, which collectively significantly impact the patient's quality of life (3). Although some patients experience spontaneous recovery within the first few weeks, delays in diagnosis and medical

intervention substantially diminish the prognosis for auditory recovery.

Tinnitus is reported by a high percentage of patients with SSNHL and often persists as a chronic condition, even when hearing thresholds show partial improvement. In cases of unilateral hearing loss, patients suffer not only from reduced auditory sensitivity but also from impaired spatial auditory processing, degraded sound localization, and compromised speech perception in noise, all of which may lead to occupational and social challenges (4). Consequently, the management of these patients must extend beyond acute pharmacological intervention to include comprehensive audiological assessment and rehabilitation, patient education, psychological

1- Instructor, Department of Audiology, School of Rehabilitation Sciences, Isfahan University of Medical Sciences, Isfahan, Iran

**Corresponding Author:** Mohammad Hossein Nilforoush; Instructor, Department of Audiology, School of Rehabilitation Sciences, Isfahan University of Medical Sciences, Isfahan, Iran; Email: mhniforoush@gmail.com

support, and the integration of hearing technologies.

This case report describes the clinical history and treatment trajectory of a patient with unilateral SSNHL and persistent tinnitus. It further emphasizes the critical role of the audiologist in early identification, prompt referral, and the design of a person-centered rehabilitation program.

### Case Report

The patient was a 49-year-old male office clerk with no prior history of hearing impairment. He presented with a complaint of awakening with aural fullness in the left ear, persistent tinnitus, and a distinct subjective decrease in hearing sensitivity. The patient reported no history of head trauma, recent otologic infections, acute exposure to high-intensity noise, or the use of known ototoxic medications. Furthermore, his medical history was negative for Meniere's disease, migraine, or autoimmune disorders. He reported experiencing mild vertigo on the first day, which resolved within 48 hours; however, the tinnitus—described as a "high-pitched whistle"—remained permanent.

Psychologically, at the time of the initial presentation, the patient exhibited significant anxiety regarding the possibility of permanent deafness and reported sleep disturbances due to the tinnitus. He is married and works in a banking environment that requires frequent telephone communication; he has noted a decline in his occupational performance since the onset of symptoms.

#### *Examination and Audiological Evaluation:*

Otoscopic examination of both ears revealed patent external auditory canals and intact tympanic membranes, with no evidence of acute inflammation or middle ear effusion. Rinne and Weber tuning fork tests were consistent with sensorineural hearing loss (SNHL) in the left ear and normal hearing in the right ear. Pure-tone audiometry (PTA) demonstrated severe-to-profound SNHL in the left ear across frequencies from 500 to 8000 Hz, while thresholds for the right ear were within normal limits. The audiometric configuration was relatively flat with a mild high-frequency slope. Speech audiometry revealed an elevated speech reception threshold (SRT) and a significantly reduced word recognition score (WRS) in the left ear, while findings for the right ear were normal (Figure 1).

Immittance audiometry showed Type A tympanograms bilaterally. Acoustic reflexes were absent in the affected ear and present in the contralateral ear, consistent with unilateral sensorineural pathology. In the evaluation of speech perception in noise, the patient reported significant

difficulty following conversations in noisy environments, particularly when the speech source was oriented toward the affected side. The standardized Tinnitus Handicap Inventory (THI) indicated a moderate-to-severe impact of tinnitus on the patient's daily functioning and mood. Furthermore, a gadolinium-enhanced Magnetic Resonance Imaging (MRI) was performed to rule out acoustic neuroma or other cerebellopontine angle (CPA) lesions, which yielded no remarkable pathological findings.

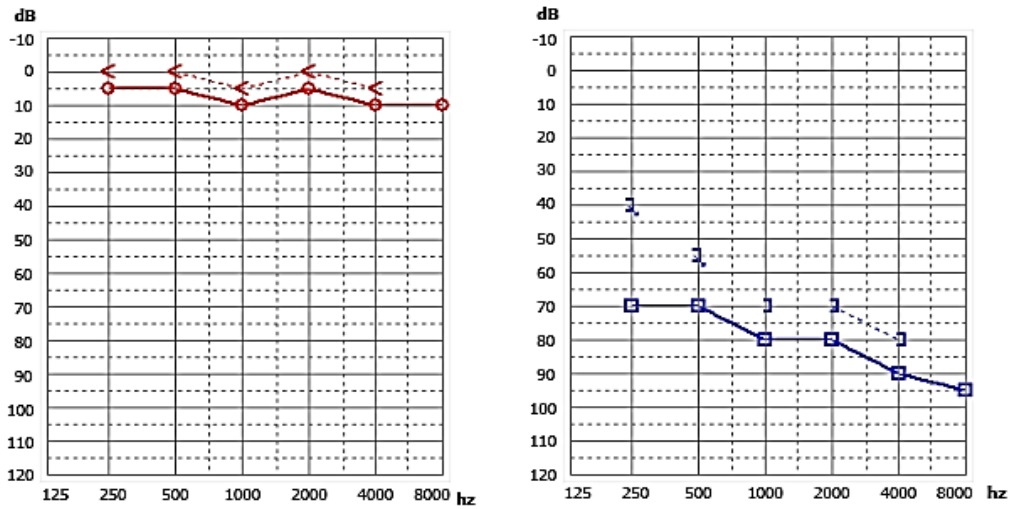
*Medical Intervention:* Given the sudden onset of symptoms and the patient's presentation within 24 hours, an otolaryngologist initiated high-dose systemic corticosteroid therapy. Follow-up audiometry performed after 10 days revealed a 20–25 dB improvement in both low and high frequencies; however, severe tinnitus and speech perception difficulties in noise persisted. Due to significant residual hearing loss, a course of salvage therapy consisting of 4 weekly intratympanic dexamethasone injections were administered, resulting in a slight improvement in thresholds at 2000 and 4000 Hz. While the vertigo resolved completely, the tinnitus showed only a marginal reduction in intensity and annoyance.

*Audiological Rehabilitation:* Following the stabilization of hearing thresholds approximately four weeks after the onset of treatment, a comprehensive audiological rehabilitation program was implemented. This program comprised the following components:

1. Educational Counseling: Informative sessions addressing the pathophysiology and prognosis of SSNHL, the neurophysiological role of the central nervous system in tinnitus perception, and the development of adaptive coping strategies.
2. Hearing Aid Fitting: Provision of a digital hearing aid for the left ear, specifically programmed and verified according to the patient's residual hearing thresholds to address the auditory deficit.
3. Tinnitus Sound Therapy: Activation of a tinnitus masker program utilizing narrowband noise at a sub-comfort level. This intervention aimed to reduce the saliency of the tinnitus and facilitate neural habituation.
4. Psychological Referral: Referral for psychological consultation to screen for comorbid anxiety and depression, and to initiate stress management and relaxation techniques.

*Follow-up:* At the three-month follow-up, pure-tone audiometry showed that the left-ear hearing thresholds at speech frequencies had not improved further and remained within the moderate-to-severe hearing loss range (Figure 2).

### Pure tone Audiometry



### Weber Audiometry

<b>RINNE R.E.:</b> Positive	250	500	1000	2000	4000	<b>RINNE L.E.:</b> Positive
<b>Frequency :</b>						<b>Frequency :</b>

### Speech Audiometry

**Right**

SAT	SRT	MCL	UCL
dB	10 dB	40 dB	dB
Discrimination in %Correct			
In Quiet		In Noise	
%100	LEVEL dB	%	LEVEL dB

**Right**

	Pb max	
	Pb min	
	Rollover	
	Rollover Index	

**Left**

SAT	SRT	MCL	UCL
dB	CNT dB	dB	dB
Discrimination in %Correct			
In Quiet		In Noise	
%CN T	LEVEL dB	%	LEVEL dB

Dear Dr.

P.T.A. : R.E: Normal Hearing  
L.E: Severe SSNHL

**Figure 1.** Pre-treatment audiometric assessment results

The patient reported a noticeable improvement in speech perception in quiet environments during consistent hearing aid use, as well as acceptable performance in moderate background noise.

Based on the standardized questionnaire, the severity and annoyance of the tinnitus decreased from "severe" to "moderate." The patient noted that in the presence of mild ambient noise or while using the hearing aid's masker program, his attention to the tinnitus was significantly reduced, and his sleep quality had improved.

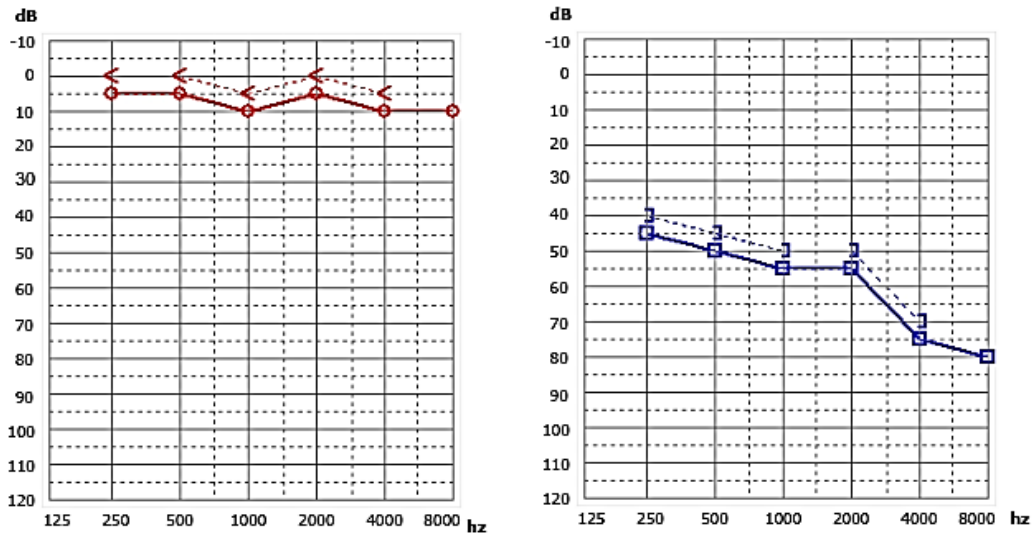
Furthermore, he found the acquired environmental

and auditory strategies beneficial and reported a greater sense of self-efficacy and control over his daily communications.

### Discussion

This case highlights the critical importance of early diagnosis and rapid intervention in unilateral sudden sensorineural hearing loss (SSNHL) associated with tinnitus. SSNHL is recognized as an otological emergency, where delays in initiating corticosteroid therapy are significantly associated with a reduced probability of threshold recovery (5).

### Pure tone Audiometry



### Weber Audiometry

<b>RINNE R.E:</b>	<b>Positive</b>	250	500	1000	2000	4000	<b>RINNE L.E:</b>	<b>Positive</b>
<b>Frequency :</b>							<b>Frequency :</b>	

### Speech Audiometry

Right				Left			
SAT	SRT	MCL	UCL	SAT	SRT	MCL	UCL
dB	10 dB	40 dB	dB	dB	55 dB	85 dB	dB
Discrimination in %Correct				Discrimination in %Correct			
In Quiet		In Noise		In Quiet		In Noise	
LEVEL	LEVEL	LEVEL	LEVEL	LEVEL	LEVEL	LEVEL	LEVEL
%100	dB	%	dB	%72	dB	%	dB

Dear Dr.

P.T.A. : R.E: Normal Hearing  
L.E: Moderate to Severe SNHL

Figure 2. Audiometric results at the three-month follow-up

In the present case, the patient's prompt presentation and the combined regimen of systemic and intratympanic injections likely contributed to the partial hearing recovery; however, the persistent severe-to-profound deficit underscores the necessity for comprehensive audiological rehabilitation. From an audiological perspective, a unilateral severe-to-profound hearing loss not only reduces hearing sensitivity but also impairs spatial processing, sound

localization, and speech-in-noise (SIN) discrimination, with extensive functional consequences. Studies on unilateral hearing loss have demonstrated that even with a healthy contralateral ear, speech perception in noise and sound localization remain challenging. Therefore, a comprehensive assessment including SIN tests and quality-of-hearing questionnaires is essential for designing targeted interventions.

In this case, tinnitus was a more persistent

symptom than vertigo, remaining stable despite the partial improvement in thresholds. This aligns with contemporary findings regarding the neural networks involved in tinnitus following SSNHL. Cortical plasticity changes and interactions with psychological factors play a pivotal role in the chronicity of tinnitus, with its perceived severity being highly dependent on the patient's anxiety and attentional levels (6). A combination of counseling, hearing aids with integrated maskers, and psychological interventions can effectively reduce the attentional saliency and emotional burden of tinnitus while facilitating habituation (7-9).

The fitting of a unilateral hearing aid in this patient served a dual purpose: partially compensating for the hearing deficit and reducing tinnitus annoyance through consistent acoustic input and spectral masking. This is consistent with recent studies emphasizing the role of amplification in tinnitus management (10-12). Furthermore, the implementation of auditory and environmental strategies, alongside psychological referral, was a cornerstone of the management plan (13). Optimal positioning during conversations, minimizing background noise, and leveraging visual cues partially mitigated the limitations of unilateral loss, consistent with findings in auditory processing studies in this population (14). Finally, the psychological intervention for managing tinnitus-related anxiety and sleep disturbance exemplifies the necessity of an interdisciplinary approach in the rehabilitation of chronic tinnitus patients (15).

### Limitations

-

### Recommendations

-

### Conclusion

Sudden sensorineural hearing loss (SSNHL) accompanied by tinnitus is an otological emergency with potential long-term implications for auditory function and quality of life. This case demonstrates that prompt medical intervention, comprehensive

audiological assessment, and a multidimensional rehabilitation program—incorporating pharmacological therapy, hearing aid fitting with integrated masking, auditory training, and psychological support—can optimize residual hearing, reduce tinnitus annoyance, and enhance communicative performance. Close collaboration between audiologists, otolaryngologists, and psychologists is paramount to ensuring optimal care and long-term outcomes for patients with this condition.

### Acknowledgments

The author would like to express sincere gratitude to the patient whose participation and cooperation made this study possible.

### Authors' Contribution

Project design and ideation: Mohammad Hossein Nilforoush

Providing financial resources for the Project: Mohammad Hossein Nilforoush

Scientific and executive support of the Project: Mohammad Hossein Nilforoush

Providing equipments and statistical sample: Mohammad Hossein Nilforoush

Data collection: Saeideh Moayedfar, Leila Ghasisin

Analysis and interpretation of the results: Mohammad Hossein Nilforoush

Specialized statistics services: Mohammad Hossein Nilforoush

Manuscript preparation: Mohammad Hossein Nilforoush

Specialized scientific evaluation of the manuscript: Mohammad Hossein Nilforoush

Confirm the final manuscript to be submitted to the journal: Mohammad Hossein Nilforoush

Maintaining the integrity of the study process from the beginning to the publication, and responding to the reviewer's comments: Mohammad Hossein Nilforoush

### Funding

-

### Conflict of Interest

The authors did not have a conflict of interest.

### References

1. Kuhn M, Heman-Ackah SE, Shaikh JA, Roehm PC. Sudden sensorineural hearing loss: a review of diagnosis, treatment, and prognosis. *Trends in amplification*. 2011; 15(3): 91-105.
2. Chau JK, Lin JR, Atashband S, Irvine RA, Westerberg BD. Systematic review of the evidence for the etiology of adult sudden sensorineural hearing loss. *The Laryngoscope*. 2010; 120(5): 1011-21.
3. Carlsson PI, Hall M, Lind KJ, Danermark B. Quality of life, psychosocial consequences, and audiological rehabilitation after sudden sensorineural hearing loss. *International Journal of Audiology*. 2011; 50(2): 139-44.

4. Khakzand S, Maarefvand M, Ruzbahani M, Tajdini A. Assessment of Peripheral and Central Auditory Processing after Treatment for Idiopathic Sudden Sensorineural Hearing Loss. *International Archives of Otorhinolaryngology*. 2024; 28(03): e415-23.
5. Lee SJ, Park J, Lee SY, Koo JW, Vanneste S, De Ridder D, Lim S, Song JJ. Triple network activation causes tinnitus in patients with sudden sensorineural hearing loss: A model-based volume-entropy analysis. *Frontiers in neuroscience*. 2022 17; 16: 1028776.
6. Tsuzuki N, Wasano K. Idiopathic sudden sensorineural hearing loss: A review focused on the contribution of vascular pathologies. *Auris Nasus Larynx*. 2024; 51(4): 747-54.
7. Zhang BY, Wang YC, Chan KC. Recurrent sudden sensorineural hearing loss—A literature review. *Laryngoscope Investigative Otolaryngology*. 2022; 7(3): 854-62.
8. Yang TH, Xirasagar S, Cheng YF, Chen CS, Lin HC. Increased prevalence of hearing loss, tinnitus and sudden deafness among patients with Sjögren's syndrome. *RMD open*. 2024; 10(1).
9. Lee SY, Choi BY, Koo JW, De Ridder D, Song JJ. Cortical oscillatory signatures reveal the prerequisites for tinnitus perception: a comparison of subjects with sudden sensorineural hearing loss with and without tinnitus. *Frontiers in Neuroscience*. 2020; 14: 596647.
10. Jeon SY, Kang DW, Kim SH, Byun JY, Yeo SG. Prognostic factors associated with recovery from recurrent idiopathic sudden sensorineural hearing loss: retrospective analysis and systematic review. *Journal of clinical medicine*. 2022; 11(5): 1453.
11. Plontke SK, Meisner C, Agrawal S, Caye-Thomasen P, Galbraith K, Mikulec AA, Parnes L, Premakumar Y, Reiber J, Schilder AG, Liebau A. Intratympanic corticosteroids for sudden sensorineural hearing loss. *The Cochrane database of systematic reviews*. 2022; 2022(7): CD008080.
12. Ayodele OS, Segun-Busari S, Omokanye KH, Dunmade DA, Ologe EF. Quality of life of tinnitus patients with and without hearing loss. *International Journal of Otorhinolaryngology and Head and Neck Surgery*. 2021; 7(1): 11.
13. Yang HW, Huang YC, Chiang KW, Wen YL, To SY, Kao S, Kao LT. Increased risk of sudden sensorineural hearing loss in patients receiving sedative-hypnotics: a propensity score weighting cohort study. *Nature and Science of Sleep*. 2024: 2231-41.
14. Wang S, Cha X, Li F, Li T, Wang T, Wang W, Zhao Z, Ye X, Liang C, Deng Y, Liu H. Associations between sleep disorders and anxiety in patients with tinnitus: a cross-sectional study. *Frontiers in psychology*. 2022; 13: 963148.
15. Association between Tinnitus and Hearing Recovery in Sudden Sensorineural Hearing Loss: A Systematic Review and Meta-analysis. *Otol Neurotol*. 2025; 46(1): e10-e20.