

Effectiveness of Steroid Therapy in Idiopathic Sudden Sensorineural Hearing Loss

¹Dr.Akanksha Dhiman, Assistant Professor, Department of ENT, Sri Siddhartha Institute of Medical Sciences and Research Centre, T Begur, Karnataka, India

²Dr.Deepika Goswami, Specialist, Department of ENT, District Combined Hospital, Sector 39, Noida, Uttar Pradesh, India

³Dr.Gabriella Yvette War, Specialist Grade 3, Department of ENT, ESIC Gurgaon, Haryana, India.

Corresponding Author: Dr. Gabriella Yvette War, Specialist Grade 3, Department of ENT, ESIC Gurgaon, Haryana, India.

How to citation this article: Dr. Akanksha Dhiman, Dr. Deepika Goswami, Dr. Gabriella Yvette War, “Effectiveness of Steroid Therapy in Idiopathic Sudden Sensorineural Hearing Loss”, IJMACR– October– 2026, Volume – 9, Issue – 5, P. No. 54 – 62.

Open Access Article: © 2026 Dr. Akanksha Dhiman, et al. This is an open access journal and article distributed under the terms of the creative common’s attribution license (<http://creativecommons.org/licenses/by/4.0>). Which allows others to remix, tweak, and build upon the work non - commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: Idiopathic sudden sensorineural hearing loss (ISSNHL) is an otological emergency characterized by rapid-onset sensorineural hearing impairment without an identifiable underlying cause. Corticosteroids remain the most frequently used pharmacological treatment; however, the magnitude of hearing recovery varies according to patient characteristics, baseline severity, treatment timing, and route of steroid administration.

Objective: To evaluate the effectiveness of steroid therapy in improving hearing outcomes among patients with idiopathic sudden sensorineural hearing loss and to identify clinical factors associated with hearing recovery.

Materials and Methods: This prospective multicentre observational study was conducted at three tertiary-care hospitals in India between May 2024 and May 2026. A

total of 100 adult patients diagnosed with unilateral ISSNHL were enrolled. Diagnosis was based on sudden sensorineural hearing loss of ≥ 30 dB involving at least three consecutive frequencies developing within 72 hours, after exclusion of identifiable causes. Patients received systemic corticosteroids, intratympanic corticosteroids, or combined systemic and intratympanic treatment according to clinical indications and institutional practice. Pure-tone audiometry was performed before and after treatment. The primary outcome was change in pure-tone average (PTA). Hearing recovery was classified as complete, partial, slight, or no recovery.

Results: The mean age of the study population was 45.8 ± 13.6 years, and 57% were male. Mean pretreatment PTA improved from 61.7 ± 18.4 dB to 39.8 ± 20.1 dB

after therapy, with a mean hearing gain of 21.9 ± 15.7 dB ($p < 0.001$). Complete recovery occurred in 32%, partial recovery in 31%, slight recovery in 17%, and no meaningful recovery in 20%. Patients treated within 7 days showed greater PTA improvement than those beginning treatment after 7 days (26.4 ± 14.8 vs 14.2 ± 13.5 dB; $p < 0.001$). Better recovery was associated with earlier treatment, lower baseline severity, and absence of vertigo.

Conclusion: Steroid therapy was associated with significant improvement in hearing among patients with ISSNHL. Early initiation of treatment, particularly within the first week after symptom onset, was associated with better hearing recovery. Baseline severity and associated vertigo also influenced prognosis.

Keywords: Idiopathic Sudden Sensorineural Hearing Loss; ISSNHL; Corticosteroids; Intratympanic Steroids; Sudden Hearing Loss; Pure-Tone Audiometry; Hearing Recovery.

Introduction

Sudden sensorineural hearing loss (SSNHL) is an acute otological condition characterized by a rapid decline in hearing occurring over a short period. It is conventionally defined audiometrically as sensorineural hearing loss of at least 30 dB affecting three consecutive frequencies and developing within 72 hours [1,2]. The condition predominantly occurs unilaterally and may be accompanied by tinnitus, aural fullness, vertigo, or combinations of these symptoms.

SSNHL represents an important clinical problem because delayed recognition and treatment can lead to persistent hearing impairment with substantial effects on communication, occupational functioning, social interaction, and quality of life. Although several

etiological mechanisms including viral infection, microvascular compromise, autoimmune disorders, cochlear membrane disruption, and inflammatory processes have been proposed, an identifiable cause cannot be established in most patients. Such cases are categorized as idiopathic sudden sensorineural hearing loss (ISSNHL)¹⁻³.

Corticosteroids have remained the mainstay of medical management for ISSNHL for several decades. Their proposed therapeutic effects include suppression of cochlear inflammation, modulation of immune responses, reduction of endolymphatic hydrops, stabilization of cellular membranes, and improvement in cochlear microcirculation^{4,5}. Systemic corticosteroids are commonly prescribed as initial therapy, whereas intratympanic administration is used as primary therapy in selected patients or as salvage therapy following inadequate response⁵⁻⁷.

The response to treatment may be influenced by age, initial severity of hearing loss, audiometric configuration, presence of vertigo, associated tinnitus, metabolic comorbidities, and particularly the interval between symptom onset and initiation of therapy⁸⁻¹⁰. Indian multicentre data remain comparatively limited. The present study was therefore undertaken to assess the effectiveness of steroid therapy in patients with ISSNHL treated at three tertiary-care hospitals in India and to evaluate factors associated with hearing recovery.

Aim and Objectives

Primary Objective

To evaluate the effectiveness of steroid therapy in improving hearing outcomes among patients diagnosed with idiopathic sudden sensorineural hearing loss.

Secondary Objectives

1. To determine the magnitude of improvement in pure-tone average following steroid therapy.
2. To determine the proportion of patients achieving complete, partial, slight, and no hearing recovery.
3. To compare hearing outcomes according to timing of initiation of steroid therapy.
4. To compare outcomes among patients receiving systemic, intratympanic, and combined steroid treatment.
5. To evaluate clinical and audiological predictors associated with favorable hearing recovery.

Materials and Methods

Study Design

A prospective, multicentre, observational study was conducted among patients presenting with idiopathic sudden sensorineural hearing loss.

Study Setting

The study was conducted in the Departments of Otorhinolaryngology at three tertiary-care hospitals in India.

Study Duration

The study was conducted over a period of 24 months, from May 2024 to May 2026.

Sample Size

A total of 100 patients fulfilling the predefined eligibility criteria were included.

Study Population

Adult patients presenting to participating tertiary-care centres with newly diagnosed unilateral sudden sensorineural hearing loss were screened for eligibility.

Inclusion Criteria

1. Age ≥ 18 years.
2. Sudden onset of unilateral sensorineural hearing loss.

3. Hearing loss developing within 72 hours.
 4. Audiometrically documented loss of ≥ 30 dB involving at least three consecutive frequencies.
 5. No identifiable cause of hearing loss following clinical evaluation.
 6. Presentation within 14 days of onset of hearing loss.
 7. Willingness to participate and provide informed consent.
 8. Availability for follow-up audiological assessment.
- ### Sample Size and Sampling Technique

Exclusion Criteria

1. Conductive or mixed hearing loss.
2. Bilateral simultaneous sudden sensorineural hearing loss.
3. Previous chronic sensorineural hearing impairment in the affected ear.
4. Meniere's disease.
5. Acoustic neuroma or other retrocochlear pathology.
6. Recent acoustic trauma.
7. Head injury temporally associated with hearing loss.
8. Ototoxic drug exposure likely to explain the hearing impairment.
9. Active middle-ear disease.
10. Identifiable infectious, neurological, autoimmune, or vascular cause explaining the hearing loss.
11. Previous treatment for the same episode before presentation to the participating centre.
12. Inability to complete follow-up audiometry.

Clinical Assessment

A detailed history was obtained regarding onset and duration of hearing loss, affected ear, tinnitus, vertigo, aural fullness, preceding upper respiratory infection, previous ear disease, noise exposure, medication history, systemic illnesses, and previous episodes of sudden hearing impairment. Comorbidities including diabetes

mellitus, hypertension and dyslipidemia were documented. All patients underwent complete otorhinolaryngological examination including otoscopy. Tuning-fork examinations using Rinne and Weber tests were performed initially.

Audiological Evaluation

Pure-tone audiometry was performed using a calibrated clinical audiometer in a sound-treated room. Air-conduction thresholds were determined at 250, 500, 1000, 2000, 4000 and 8000 Hz, while bone-conduction thresholds were assessed at appropriate frequencies. The pure-tone average was calculated using thresholds at 500, 1000, 2000 and 4000 Hz. Baseline audiometry was performed before treatment, followed by repeat audiometry after completion of the primary treatment course.

Severity of Hearing Loss

PTA	Severity
26-40 dB	Mild
41-55 dB	Moderate
56-70 dB	Moderately severe
71-90 dB	Severe
>90 dB	Profound

Treatment Protocol

Systemic Steroid Therapy

Patients considered suitable for systemic treatment received oral prednisolone approximately 1 mg/kg/day, up to a maximum of 60 mg/day, followed by dose tapering according to the treating physician's protocol. Patients were monitored for corticosteroid-related adverse effects.

Intratympanic Steroid Therapy

Intratympanic corticosteroid treatment was administered to selected patients as primary therapy when systemic treatment was contraindicated, or as adjunctive/salvage

treatment in patients demonstrating incomplete recovery. Dexamethasone or methylprednisolone was administered intratympanically according to institutional protocols under aseptic conditions.

Combined Therapy

Patients receiving systemic corticosteroids together with intratympanic corticosteroid administration were classified as receiving combined therapy.

Outcome Measures

The primary outcome was improvement in pure-tone average following steroid treatment. Hearing gain was calculated as pretreatment PTA minus post-treatment PTA. Recovery was categorized as complete, partial, slight, or no recovery using predefined audiological criteria.

Statistical Analysis

Continuous variables were expressed as mean $\pm$ standard deviation or median with interquartile range, depending on distribution. Categorical variables were expressed as frequencies and percentages. Pretreatment and post-treatment PTA values were compared using paired-samples t-test or Wilcoxon signed-rank test as appropriate. Independent-samples t-test or analysis of variance was used for between-group comparisons, while categorical variables were compared using chi-square or Fisher's exact test. Multivariable logistic regression was used to identify independent predictors of favorable hearing recovery. A two-sided p-value <0.05 was considered statistically significant.

Ethical Considerations

The study was conducted in accordance with the principles of the Declaration of Helsinki. Approval was obtained from the respective Institutional Ethics Committees of the three participating tertiary-care hospitals before initiation of the study. Written informed

consent was obtained from all participants before enrolment.

Results

A total of 112 patients with suspected SSNHL were initially screened. Twelve were excluded because they did not fulfil the eligibility criteria or had an identifiable secondary cause of hearing loss. The final study included 100 patients with ISSNHL.

Demographic and Clinical Characteristics

The mean age of the participants was 45.8 ± 13.6 years (range 19-74 years). Fifty-seven patients (57%) were male and 43 (43%) were female. The right ear was involved in 52 patients (52%) and the left ear in 48 (48%). Tinnitus was present in 69%, vertigo in 28%, and aural fullness in 41%.

Characteristic	Value
Total patients	100
Age, years, mean $\pm$ SD	45.8 ± 13.6
Age <40 years	34 (34%)
Age 40-59 years	43 (43%)
Age $\geq$ 60 years	23 (23%)
Male	57 (57%)
Female	43 (43%)
Right ear affected	52 (52%)
Left ear affected	48 (48%)
Tinnitus	69 (69%)
Vertigo	28 (28%)
Aural fullness	41 (41%)
Diabetes mellitus	19 (19%)
Hypertension	24 (24%)
Dyslipidemia	17 (17%)

Baseline Severity of Hearing Loss

The mean pretreatment PTA was 61.7 ± 18.4 dB. Moderately severe hearing loss represented the most frequent category.

Baseline hearing loss	Patients, n (%)
Mild	9 (9%)
Moderate	25 (25%)
Moderately severe	31 (31%)
Severe	24 (24%)
Profound	11 (11%)
Total	100 (100%)

Timing of Treatment

Fifty-eight patients (58%) started steroid treatment within 7 days of symptom onset, whereas 42 patients (42%) began treatment between 8 and 14 days. The median interval from onset to treatment was approximately 6 days.

Treatment Modalities

Systemic corticosteroids alone were administered to 54 patients, intratympanic corticosteroids alone to 15 patients, and combined systemic plus intratympanic treatment to 31 patients.

Treatment modality	n (%)
Systemic corticosteroids alone	54 (54%)
Intratympanic corticosteroids alone	15 (15%)
Combined systemic + intratympanic corticosteroids	31 (31%)
Total	100 (100%)

Overall Audiological Outcome

The mean PTA decreased from 61.7 ± 18.4 dB before treatment to 39.8 ± 20.1 dB following treatment. The mean hearing gain was 21.9 ± 15.7 dB. The reduction in PTA was statistically significant ($p < 0.001$).

Audiological parameter	Mean $\pm$ SD
Pretreatment PTA	61.7 ± 18.4 dB
Post-treatment PTA	39.8 ± 20.1 dB
Mean hearing gain	21.9 ± 15.7 dB
p-value	<0.001

Degree of Hearing Recovery

Complete hearing recovery was observed in 32 patients (32%), partial recovery in 31 (31%), slight recovery in 17 (17%), and no meaningful recovery in 20 (20%). Overall, 63% achieved either complete or partial recovery.

Recovery category	n (%)
Complete recovery	32 (32%)
Partial recovery	31 (31%)
Slight recovery	17 (17%)
No recovery	20 (20%)
Total	100 (100%)

Effect of Timing of Steroid Treatment

Patients who started treatment within 7 days experienced greater hearing improvement than those beginning treatment between 8 and 14 days. Mean hearing gain was 26.4 ± 14.8 dB versus 14.2 ± 13.5 dB, respectively ($p < 0.001$).

Parameter	≤ 7 days (n=58)	8-14 days (n=42)	p-value
Baseline PTA, dB	60.9 ± 17.6	62.8 ± 19.5	0.61
Mean hearing gain, dB	26.4 ± 14.8	14.2 ± 13.5	<0.001
Complete/partial recovery	44 (75.9%)	19 (45.2%)	0.002
Slight/no recovery	14 (24.1%)	23 (54.8%)	

Outcome According to Treatment Modality

Treatment	n	Baseline PTA, dB	Post-treatment PTA, dB	Hearing gain, dB
Systemic steroid alone	54	58.9 ± 17.3	39.6 ± 19.4	19.3 ± 14.8

Intratympanic steroid alone	15	62.1 ± 18.5	43.6 ± 20.8	18.5 ± 14.1
Combined therapy	31	66.4 ± 19.5	38.4 ± 21.3	28.0 ± 16.1

The combined-treatment group demonstrated the greatest numerical improvement in PTA. However, because treatment allocation was not randomized and baseline severity differed between groups, these differences should not be interpreted as proof of superiority.

Relationship Between Baseline Severity and Recovery

Baseline severity	n	Complete/partial recovery n (%)	Slight/no recovery n (%)
Mild	9	8 (88.9%)	1 (11.1%)
Moderate	25	20 (80.0%)	5 (20.0%)
Moderately severe	31	21 (67.7%)	10 (32.3%)
Severe	24	11 (45.8%)	13 (54.2%)
Profound	11	3 (27.3%)	8 (72.7%)

The association between baseline severity and recovery was statistically significant ($p < 0.01$).

Association of Vertigo with Hearing Recovery

Among the 28 patients with vertigo, 12 (42.9%) achieved complete or partial recovery compared with 51 of 72 patients (70.8%) without vertigo ($p = 0.009$).

Clinical factor	Complete/partial recovery	Slight/no recovery	p-value
Vertigo present (n=28)	12 (42.9%)	16 (57.1%)	0.009
Vertigo absent (n=72)	51 (70.8%)	21 (29.2%)	
Tinnitus	46 (66.7%)	23 (33.3%)	0.27

present (n=69)			
Tinnitus absent (n=31)	17 (54.8%)	14 (45.2%)	

Predictors of Favorable Hearing Recovery

Variable	Adjusted OR	95% CI	p-value
Treatment initiated ≤ 7 days	3.42	1.39-8.44	0.008
Age <50 years	2.11	0.91-4.90	0.081
Mild/moderate baseline hearing loss	3.06	1.16-8.07	0.024
Vertigo present	0.39	0.16-0.97	0.043
Diabetes mellitus	0.73	0.25-2.14	0.57
Combined steroid therapy	1.61	0.65-4.01	0.31

Early treatment and lower initial hearing-loss severity were independently associated with favorable hearing recovery, whereas the presence of vertigo was associated with reduced odds of favorable recovery.

Adverse Effects

Steroid therapy was generally well tolerated. No serious treatment-related adverse event was observed.

Adverse effect	n (%)
Dyspepsia	8 (8%)
Transient hyperglycemia	6 (6%)
Sleep disturbance	5 (5%)
Transient ear pain/discomfort	7 (7%)
Transient dizziness after IT injection	3 (3%)
Persistent tympanic membrane perforation	0
Serious adverse event	0

Discussion

The present multicentre study evaluated hearing recovery following corticosteroid therapy among 100 patients with idiopathic sudden sensorineural hearing loss managed at three tertiary-care hospitals in India. A significant improvement in audiometric thresholds was observed following steroid treatment, with mean PTA improving by approximately 22 dB. Nearly two-thirds of patients achieved complete or partial hearing recovery. ISSNHL remains a clinically challenging disorder because its pathophysiology is incompletely understood and its natural course is highly variable. Proposed mechanisms include inflammatory, viral, vascular, immunological, oxidative and cochlear membrane disturbances^{3,4}. Corticosteroids potentially influence several of these pathways through their anti-inflammatory and immunomodulatory properties.

The mean age in the present study was approximately 46 years, with a slight male predominance. Tinnitus was the commonest associated symptom, followed by aural fullness and vertigo. The overall hearing response was clinically meaningful, with pretreatment PTA decreasing from approximately 62 dB to 40 dB following treatment. A particularly important finding was the association between treatment delay and poorer outcome. Patients treated within seven days experienced substantially greater hearing improvement than patients treated after the first week. Approximately three-quarters of early-treated patients achieved complete or partial recovery compared with fewer than half of patients in whom treatment commenced later.

Baseline severity strongly influenced prognosis. Patients with mild or moderate hearing loss demonstrated greater recovery than those with severe or profound hearing impairment. The presence of vertigo was another

unfavorable prognostic marker and may indicate more extensive labyrinthine involvement.

The role of intratympanic steroids has continued to expand because intratympanic administration provides high local corticosteroid concentrations while limiting systemic exposure. In the present study, combined systemic and intratympanic therapy showed the greatest numerical improvement in PTA. However, this finding should be interpreted cautiously because treatment selection was not randomized and patients receiving combination therapy tended to have greater baseline hearing loss.

The findings emphasize an individualized approach to treatment. Systemic corticosteroids remain a practical initial treatment for patients without major contraindications, while intratympanic corticosteroids provide an important alternative or adjunct, particularly when systemic therapy is unsuitable or initial recovery remains inadequate.

Clinical Implications

- Patients presenting with sudden unilateral hearing loss should undergo prompt differentiation between conductive and sensorineural hearing impairment.
- Audiometry should be performed without unnecessary delay.
- Once ISSNHL has been established and secondary causes appropriately excluded, corticosteroid treatment should be considered promptly after discussion of potential benefits, limitations and adverse effects.
- Patients showing incomplete recovery after initial therapy should be reassessed for additional therapeutic options including intratympanic corticosteroids.
- Patients with profound baseline hearing impairment, vertigo, or delayed presentation should be counselled regarding their comparatively poorer prognosis.

Strengths of the Study

The study was conducted across three tertiary-care hospitals, improving representation beyond a single institutional population. A uniform audiological outcome measure based on pure-tone audiometry was used. The study also examined clinically relevant prognostic variables including treatment timing, baseline hearing severity and vestibular symptoms.

Limitations

The study was observational rather than randomized, and treatment-group comparisons may therefore be affected by selection bias. Spontaneous hearing recovery is known to occur in ISSNHL; in the absence of an untreated control group, the proportion of improvement directly attributable to corticosteroid therapy cannot be determined conclusively. Treatment protocols may have differed slightly between participating centres, particularly regarding systemic tapering schedules and intratympanic steroid concentration. The sample size limited subgroup analyses, and longer-term audiological and patient-reported outcomes were not uniformly available.

Conclusion

Steroid therapy was associated with significant audiological improvement in patients with idiopathic sudden sensorineural hearing loss in this multicentre study. Approximately two-thirds of patients achieved complete or partial hearing recovery. Earlier initiation of treatment, particularly within seven days, was associated with greater hearing improvement. Lower baseline hearing-loss severity was associated with better prognosis, whereas accompanying vertigo was associated with poorer recovery. Systemic, intratympanic and combined corticosteroid approaches all produced hearing improvement; however, the

observational design does not permit conclusions regarding superiority between strategies.

References

1. Wilson WR, Byl FM, Laird N. The efficacy of steroids in the treatment of idiopathic sudden hearing loss. *Arch Otolaryngol.* 1980;106(12):772-776.
2. Chandrasekhar SS, Tsai Do BS, Schwartz SR, et al. Clinical Practice Guideline: Sudden Hearing Loss (Update). *Otolaryngol Head Neck Surg.* 2019;161(1 Suppl):S1-S45.
3. Kuhn M, Heman-Ackah SE, Shaikh JA, Roehm PC. Sudden sensorineural hearing loss: a review of diagnosis, treatment, and prognosis. *Trends Amplif.* 2011;15(3):91-105.
4. Rauch SD. Clinical practice. Idiopathic sudden sensorineural hearing loss. *N Engl J Med.* 2008;359(8):833-840.
5. Stachler RJ, Chandrasekhar SS, Archer SM, et al. Clinical practice guideline: sudden hearing loss. *Otolaryngol Head Neck Surg.* 2012;146(3 Suppl):S1-S35.
6. Rauch SD, Halpin CF, Antonelli PJ, et al. Oral vs intratympanic corticosteroid therapy for idiopathic sudden sensorineural hearing loss: a randomized trial. *JAMA.* 2011;305(20):2071-2079.
7. Spear SA, Schwartz SR. Intratympanic steroids for sudden sensorineural hearing loss: a systematic review. *Otolaryngol Head Neck Surg.* 2011;145(4):534-543.
8. Conlin AE, Parnes LS. Treatment of sudden sensorineural hearing loss: I. A systematic review. *Arch Otolaryngol Head Neck Surg.* 2007;133(6):573-581.
9. Xenellis J, Karapatsas I, Papadimitriou N, et al. Idiopathic sudden sensorineural hearing loss: prognostic factors. *J Laryngol Otol.* 2006;120(9):718-724.
10. Cvorović L, Deric D, Probst R, Hegemann S. Prognostic model for predicting hearing recovery in idiopathic sudden sensorineural hearing loss. *Otol Neurotol.* 2008;29(4):464-469.
11. Wei BPC, Stathopoulos D, O'Leary S. Steroids for idiopathic sudden sensorineural hearing loss. *Cochrane Database Syst Rev.* 2013;(7):CD003998.
12. Herrera M, García Berrocal JR, García Arumí A, Lavilla MJ, Plaza G. Update on consensus on diagnosis and treatment of idiopathic sudden sensorineural hearing loss. *Acta Otorrinolaringol Esp.* 2019;70(5):290-300.
13. Marx M, Younes E, Chandrasekhar SS, et al. International consensus (ICON) on treatment of sudden sensorineural hearing loss. *Eur Ann Otorhinolaryngol Head Neck Dis.* 2018;135(1 Suppl):S23-S28.
14. Alexander TH, Harris JP. Incidence of sudden sensorineural hearing loss. *Otol Neurotol.* 2013;34(9):1586-1589.
15. Alosaimi SM, Alotaibi NE, Malek AI, et al. Systemic corticosteroids versus intratympanic corticosteroids as primary treatments for idiopathic sudden sensorineural hearing loss: a systematic review and meta-analysis. *Ear Nose Throat J.* Published online May 7, 2026.