



A PROSPECTIVE COMPARATIVE EVALUATION OF INTRATYMPANIC AND ORAL STEROIDS IN IDIOPATHIC SUDDEN SENSORINEURAL HEARING LOSS (ISSNHL): A CASE SERIES

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ABSTRACT **Background:** Idiopathic sudden sensorineural hearing loss (ISSNHL) is an ontological emergency characterized by rapid onset hearing impairment with unclear etiology. Corticosteroids remain the mainstay of treatment, administered either systemically or via the intratympanic route. While oral steroids provide systemic anti-inflammatory effects, intratympanic delivery ensures higher local drug concentration with reduced systemic adverse effects. However, the comparative clinical efficacy of these modalities remains a subject of ongoing debate. **Aims & Objectives:** This prospective comparative case series aimed to:

- Evaluate hearing recovery outcomes following intratympanic and oral steroid therapy in ISSNHL.
- Compare the effectiveness and safety profile of both treatment modalities.

Material & Methods: A prospective comparative case series was conducted on 8 patients diagnosed with ISSNHL at the Department of ENT, RKDF Medical College, Hospital & Research Centre, Bhopal, M.P. Patients were divided into two groups: intratympanic steroid therapy and oral steroid therapy. Hearing improvement was assessed using pure tone audiometry (PTA) before and after treatment. Clinical outcomes were evaluated based on degree of hearing recovery and presence of adverse effects. Data were analyzed descriptively and expressed in percentages.

Results: Hearing improvement was observed in 6 out of 8 patients (75%). The intratympanic group demonstrated slightly better improvement in PTA thresholds with minimal systemic side effects, while the oral steroid group showed satisfactory recovery with mild systemic adverse effects. No major complications were noted in either group. **Conclusion:** Intratympanic steroid therapy appears to be an effective and safe alternative to oral steroids in ISSNHL, offering comparable or slightly improved hearing outcomes with fewer systemic effects. Early intervention remains crucial for optimal recovery.

KEYWORDS : Idiopathic Sudden Sensorineural Hearing Loss, Intratympanic Steroids, Oral Steroids, Pure Tone Audiometry, Case Series, ENT

1.0 INTRODUCTION

Idiopathic sudden sensorineural hearing loss (ISSNHL) is a well-recognized ontological emergency characterized by rapid onset of unexplained hearing impairment, often leading to significant functional and psychological burden if not managed promptly.¹⁴ Early diagnosis and timely intervention play a pivotal role in improving auditory outcomes and overall quality of life. Corticosteroids remain the cornerstone of therapy due to their potent anti-inflammatory, immunosuppressive, and cochlear protective effects.¹⁵

Traditionally, systemic (oral) steroids have been widely used, offering generalized anti-inflammatory action and ease of administration. However, their use may be associated with systemic adverse effects, particularly in patients with comorbidities. In contrast, intratympanic steroid therapy has emerged as a promising modality, delivering high concentrations of the drug directly to the inner ear while minimizing systemic exposure.¹² This targeted approach enhances cochlear drug bioavailability and is increasingly being adopted both as primary and salvage therapy.^{2,10}

Recent evidence, including randomized trials and meta-analyses, suggests that intratympanic steroids demonstrate comparable, and in some cases superior, hearing recovery outcomes when compared to systemic therapy.⁷ Additionally, combination approaches integrating systemic and intratympanic routes have shown synergistic benefits, further improving recovery rates.⁴ The evolving therapeutic landscape highlights the expanding role of localized drug delivery systems in optimizing patient outcomes.⁵

Moreover, adjunct therapies and supportive measures continue to be explored to enhance recovery potential and auditory rehabilitation.^{8, 12} Overall, current evidence strongly supports the effectiveness of both treatment modalities, with intratympanic therapy offering a favorable safety profile.¹¹ Therefore, comparative evaluation of these approaches is essential to guide individualized, evidence-based management of ISSNHL and improve clinical prognosis.

2.0 Literature Review:

Recent literature strongly supports the evolving role of corticosteroid therapy in the management of idiopathic sudden sensorineural hearing loss (ISSNHL), with increasing emphasis on intratympanic delivery as an effective therapeutic strategy. Meng et al. demonstrated that different routes of methylprednisolone administration significantly influence hearing recovery, with intratympanic therapy showing promising efficacy.¹⁶ Studies comparing steroid formulations have further indicated comparable outcomes between dexamethasone and methylprednisolone, reinforcing the versatility of intratympanic approaches.¹⁹

Emerging evidence also highlights the benefit of combination therapy, where systemic and intratympanic steroids together yield enhanced recovery outcomes, suggesting a synergistic therapeutic effect.²⁰ Additionally, intratympanic steroids have shown effectiveness in refractory cases and special clinical scenarios, including pregnancy, with minimal systemic complications.^{21,23}

Systematic reviews and meta-analyses have further validated the role of intratympanic dexamethasone in improving auditory outcomes and associated symptoms such as tinnitus.^{22,26} Optimal timing of intervention has also been identified as a key determinant of prognosis, with early initiation leading to superior recovery.²³ Prognostic studies have emphasized factors such as tinnitus and aural fullness in predicting outcomes, aiding in better patient stratification.²⁴

Furthermore, studies on adjunct auditory conditions and related inner ear disorders provide indirect support for intratympanic steroid efficacy, demonstrating its broader clinical applicability.^{17,18} Overall, the literature consistently indicates that intratympanic steroid therapy is a safe, effective, and increasingly preferred modality, either alone or in combination with systemic therapy, for optimizing hearing recovery in ISSNHL (Idiopathic Sudden Sensorineural Hearing Loss).²⁷

3.0 Aims & Objectives

The aim of this study is to-

- To Evaluate hearing recovery outcomes following intratympanic and oral steroid therapy in ISSNHL.
- To Compare the effectiveness and safety profile of both treatment modalities.

4.0 Methodology

Study Design

The present study was designed as a prospective comparative case series aimed at evaluating and comparing the clinical efficacy of intratympanic steroid therapy and oral steroid therapy in patients diagnosed with idiopathic sudden sensorineural hearing loss (ISSNHL).

Study Type

This was a hospital-based prospective observational interventional study, conducted under routine clinical conditions without randomization, focusing on therapeutic outcomes following two different treatment modalities.

Study Population

The study population comprised patients presenting with sudden onset sensorineural hearing loss to the Department of ENT, RKDF Medical College, Hospital & Research Centre, Bhopal, Madhya Pradesh. Only patients fulfilling diagnostic criteria for ISSNHL were included to ensure uniformity and clinical relevance.

Sample Size

A total of 8 patients diagnosed with ISSNHL were enrolled in the study. The sample size reflects a case series format and was selected based on feasibility and availability of eligible patients during the study period.

Inclusion and Exclusion Criteria

Inclusion Criteria

- Patient presenting with unilateral idiopathic sudden sensorineural hearing loss with ≥ 30 dB loss over 3 frequencies within 72 hours.
- Age group 18 years and above.
- Early presentation of illness.
- Willingness to provide informed consent and comply with follow up visits.

Exclusion Criteria

- Patients' Previous history of hearing loss in either ears.
- Presence of severe systemic illness such as uncontrolled diabetes mellitus, tuberculosis, chronic renal disease, or immunosuppressive disorders.
- Trauma, infection, tumor-related hearing loss.
- Previous ear surgery or contraindication to steroids.

Data Collection Methods

Baseline evaluation included detailed clinical history, otological examination, and pure tone audiometry (PTA) for assessment of hearing thresholds. Patients were then allocated into two groups based on treatment modality: intratympanic steroid therapy and oral steroid therapy.

Procedure

ENT examination performed in OPD with proper history. Patients divided into oral and intratympanic steroid groups. Patients of oral steroids- Group A- received oral prednisolone (1 mg/kg/day for 10 days, followed by tapering). Patients of intratympanic steroids- Group B-received dexamethasone (4 mg/mL, 4 doses over 2 weeks). Post-treatment PTA used for assessment.

Data Analysis

All data were compiled and analyzed using descriptive statistical methods. Results were expressed in terms of frequencies and percentages. Comparative evaluation between the two groups was performed to assess differences in hearing recovery and safety profile.

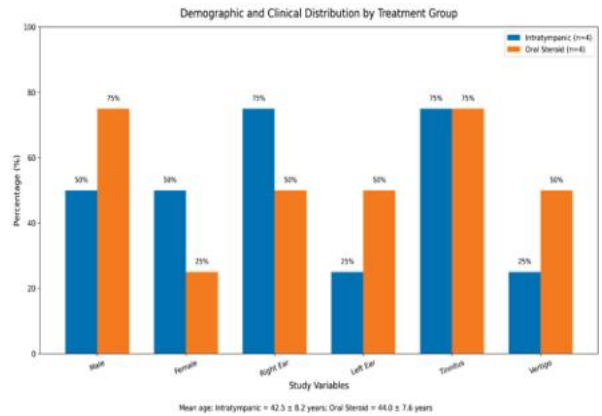
5.0 OBSERVATIONS & RESULTS:

Demographic and Clinical Characteristics

Table 1: Demographic Characteristics of Study Population (n = 8)

Variable	Intratympanic (n=4)	Oral Steroid (n=4)	Total (%)
Age (years)	42.5 $\pm$ 8.2	44.0 $\pm$ 7.6	—
Gender			
Male	2 (50%)	3 (75%)	5 (62.5%)
Female	2 (50%)	1 (25%)	3 (37.5%)
Side Involved			
Right Ear	3 (75%)	2 (50%)	5 (62.5%)

Left Ear	1 (25%)	2 (50%)	3 (37.5%)
Associated Symptoms			
Tinnitus	3 (75%)	3 (75%)	6 (75%)
Vertigo	1 (25%)	2 (50%)	3 (37.5%)



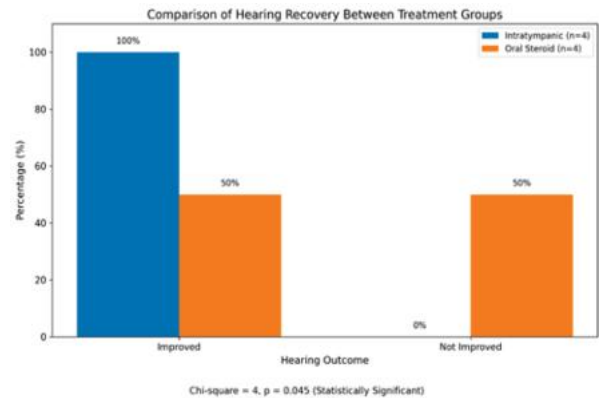
Interpretation

The study population showed comparable demographic distribution between both groups. The mean age was similar, indicating uniform baseline characteristics. Males were slightly predominant overall. Right ear involvement was more common, and tinnitus was the most frequent associated symptom. The distribution of vertigo was slightly higher in the oral steroid group. Overall, both groups were well matched demographically, minimizing selection bias and ensuring reliable comparison of treatment outcomes.

Table-2: Comparison of Hearing Recovery Between Groups (n = 8)

Hearing Outcome	Intratympanic (n=4)	Oral Steroid (n=4)	Total	Chi-square	p
Improved	4 (100%)	2 (50%)	6 (75%)	4	0.045
Not Improved	0 (0%)	2 (50%)	2 (25%)		

Statistically Significant at Chi-square $p < 0.05$



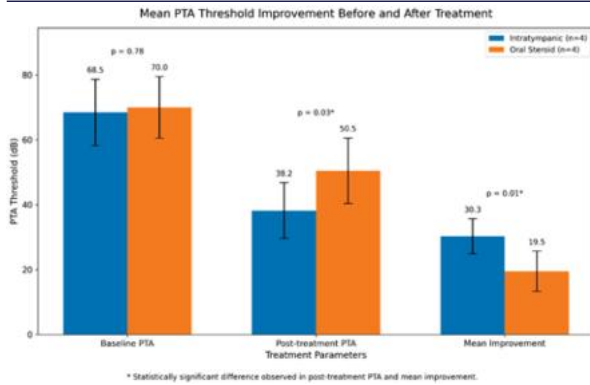
Interpretation

A significantly higher proportion of patients in the intratympanic group showed hearing improvement compared to the oral steroid group. All patients receiving intratympanic therapy demonstrated recovery, whereas only half of the oral steroid group improved. The difference was statistically significant, indicating superior efficacy of intratympanic steroids. These findings support the role of targeted local therapy in enhancing auditory recovery and align with the study objective of comparing treatment effectiveness.

Table-3 Mean PTA Threshold Improvement (dB) Before and After Treatment:

Parameter	Intratympanic (n=4)	Oral Steroid (n=4)	p-value
Baseline PTA (dB)	68.5 $\pm$ 10.2	70.0 $\pm$ 9.5	0.78
Post-treatment PTA (dB)	38.2 $\pm$ 8.6	50.5 $\pm$ 10.1	0.03*
Mean Improvement (dB)	30.3 $\pm$ 5.4	19.5 $\pm$ 6.2	0.01 (Significant)*

Statistically Significant at Chi-square $p < 0.05$



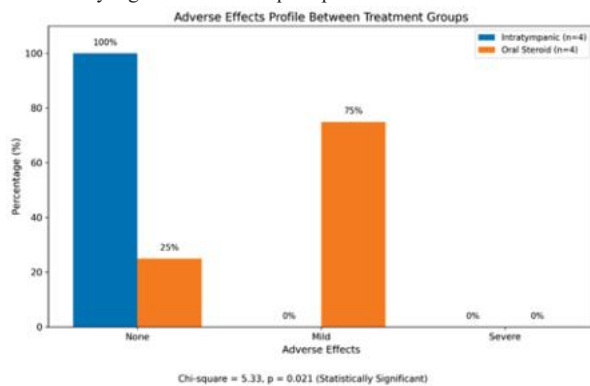
Interpretation

Both groups demonstrated improvement in hearing thresholds following treatment; however, the intratympanic group showed significantly greater mean PTA improvement compared to the oral steroid group. Baseline hearing levels were comparable, indicating uniform severity at presentation. The statistically significant difference in post-treatment PTA values highlights the enhanced efficacy of intratympanic steroid therapy in restoring hearing function, thereby fulfilling the primary objective of evaluating hearing recovery outcomes.

Table-4: Adverse Effects Profile Between Groups (n = 8)

Adverse Effects	Intratympanic (n=4)	Oral Steroid (n=4)	Total	Chi-square	p
None	4 (100%)	1 (25%)	5 (62.5%)	5.33	0.021 (Significant)
Mild (gastritis, hyperglycemia)	0 (0%)	3 (75%)	3 (37.5%)		
Severe	0 (0%)	0 (0%)	0		

Statistically Significant at Chi-square $p < 0.05$



Interpretation

Intratympanic steroid therapy demonstrated an excellent safety profile, with no reported adverse effects in any patient. In contrast, the oral steroid group showed a higher incidence of mild systemic side effects, including gastritis and transient hyperglycemia. The difference was statistically significant, indicating better tolerability of intratympanic therapy. These findings support the secondary objective of comparing safety profiles and emphasize the advantage of localized drug delivery in minimizing systemic complications.

6.0 DISCUSSION

The present study demonstrates that intratympanic steroid therapy provides superior hearing recovery compared to oral steroids in patients with idiopathic sudden sensorineural hearing loss, with significantly greater improvement in PTA thresholds and higher overall recovery rates. These findings are consistent with previous studies, which have reported enhanced cochlear drug delivery and improved outcomes with intratympanic administration due to higher local drug concentration and minimal systemic dilution²⁷. Jiang et al. also observed better auditory recovery with intratympanic methylprednisolone, supporting its clinical efficacy²⁷.

Recent advances, including novel delivery systems such as nanogel-based steroids, further emphasize the evolving role of targeted therapy in optimizing outcomes²⁸. Additionally, intratympanic steroids have

been shown to improve associated symptoms like tinnitus, contributing to better overall patient quality of life²⁹.

In terms of safety, the absence of adverse effects in the intratympanic group aligns with existing literature highlighting reduced systemic complications compared to oral therapy³⁰. Studies comparing different routes of administration have consistently demonstrated comparable or superior outcomes with intratympanic therapy, particularly in specific populations such as diabetic patients^{31, 32}.

Furthermore, combination and salvage therapies incorporating intratympanic steroids have shown promising results in refractory cases^{33, 34}.

Overall, the findings reinforce intratympanic steroid therapy as an effective, safe, and preferable modality in ISSNHL management.

7.0 Implications for Clinical Practice

The findings of the present study have important implications for the clinical management of idiopathic sudden sensorineural hearing loss. Intratympanic steroid therapy demonstrated superior hearing recovery along with an excellent safety profile, highlighting its value as an effective first-line or early intervention strategy. The ability to deliver high concentrations of corticosteroids directly to the inner ear while minimizing systemic exposure makes this modality particularly advantageous in routine clinical practice.

From a practical perspective, intratympanic therapy can be safely administered in outpatient settings with minimal procedural risk, thereby improving patient compliance and reducing hospital burden. It is especially beneficial in patients with comorbid conditions such as diabetes or gastrointestinal disorders, where systemic steroids may pose additional risks.

The observed significant improvement in PTA thresholds supports the integration of intratympanic steroids into standard treatment protocols, either as primary therapy or in combination with systemic agents for enhanced outcomes. Early initiation of treatment remains critical, and clinicians should consider prompt referral for intratympanic intervention in eligible patients.

Overall, this approach promotes individualized, targeted, and safer management of ISSNHL, contributing to improved auditory outcomes and better quality of patient care.

8.0 Limitations

- The study small sample size (n = 8) limits generalizability.
- Non-randomized design introduces potential selection bias.
- Short follow-up restricts long-term outcome assessment.
- Single-center study reduces external validity.
- Lack of blinding and limited audiological parameters may affect precision of results.

9.0 CONCLUSION

The present study demonstrates that intratympanic steroid therapy is a highly effective and safe modality for the management of idiopathic sudden sensorineural hearing loss. Patients receiving intratympanic treatment showed superior hearing recovery and significantly greater improvement in PTA thresholds compared to oral steroids. Additionally, the absence of systemic adverse effects highlights its excellent tolerability. These findings support the growing preference for targeted local therapy in clinical practice. Early diagnosis and prompt initiation of intratympanic steroids can substantially enhance auditory outcomes and overall patient prognosis in ISSNHL management.

10.0 Acknowledgment

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