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CRITICAL EVALUATION OF TREATMENT PROTOCOLS IN IDIOPATHIC SUDDEN SENSORINEURAL HEARING LOSS

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Abstract

Background: Idiopathic sudden sensorineural hearing loss (ISSNHL) is an otologic emergency characterized by rapid onset hearing impairment with an unclear etiology. Owing to the lack of definitive pathophysiological mechanisms, multiple management protocols are employed worldwide with variable outcomes. This study aims to critically analyze current management strategies for ISSNHL with emphasis on treatment modalities, timing of intervention, and hearing recovery outcomes.

Methodology: A structured critical review of English-language literature published between 2000 and 2024 was conducted using PubMed, Google Scholar, and the Cochrane Library. Studies involving adult patients with ISSNHL and reporting treatment outcomes were included. Data were extracted and categorized based on type of treatment modality, timing of therapy initiation, and degree of hearing recovery. A qualitative descriptive analysis was performed due to heterogeneity among studies.

Results: Corticosteroid therapy, administered systemically, intra tympanically, or in combination, emerged as the most effective management approach. Early initiation of treatment (≤7 days) was associated with significantly higher hearing recovery rates. Combined systemic and intra tympanic steroid therapy demonstrated superior outcomes compared to monotherapy, particularly in severe cases. Adjunctive hyperbaric oxygen therapy provided modest additional benefit, while non-steroidal therapies showed limited and inconsistent efficacy.

Conclusion: Early, steroid-based intervention remains the cornerstone of ISSNHL management. Combined therapeutic approaches may improve outcomes in selected patients, whereas routine use of non-steroidal treatments is not supported by strong evidence. Standardized treatment protocols and further high-quality clinical trials are required to optimize evidence-based management of ISSNHL.

Keywords: Idiopathic sudden sensorineural hearing loss; ISSNHL; corticosteroids; intra tympanic therapy; hyperbaric oxygen therapy; hearing recovery

Introduction

Idiopathic sudden sensorineural hearing loss (ISSNHL) is a distinct clinical entity characterized by the abrupt onset of sensorineural hearing impairment, typically defined as a loss of at least 30 dB across three consecutive audiometric frequencies occurring within a 72-hour period, without an identifiable cause after appropriate evaluation (1,2). Although considered relatively uncommon, ISSNHL represents an otologic emergency due to its unpredictable course and the potential for irreversible auditory dysfunction. (3,4) The estimated global incidence ranges from 5 to 20 cases per 100,000 individuals annually; however, the true burden of disease is likely underestimated because of spontaneous recovery in some patients and delayed presentation in others (5-7).

The pathophysiology of ISSNHL remains poorly understood, contributing significantly to the ongoing controversy surrounding its optimal management. Several hypotheses have been proposed to explain its etiology, including viral infections affecting the cochlea or cochlear nerve, microvascular compromise of the inner ear, autoimmune-mediated inflammation, and disruption of the cochlear membranes (8-10). Despite extensive research, no single mechanism adequately accounts for all clinical presentations, and it is likely that ISSNHL represents a heterogeneous condition with multiple underlying pathological pathways (11) This etiological ambiguity has led to the development of diverse and often inconsistent treatment protocols across institutions and geographic regions.

Corticosteroid therapy has emerged as the cornerstone of ISSNHL management owing to its potent anti-inflammatory and immunosuppressive properties.(12) Systemic steroids have traditionally been used as first-line treatment, while intra tympanic steroid administration has gained increasing acceptance as either primary therapy or salvage treatment in cases refractory to systemic therapy(13). In addition to steroids, several adjunctive modalities including hyperbaric oxygen therapy, antiviral agents, vasodilators, antioxidants, and rheologic agents have been employed with varying degrees of reported success. However, the clinical benefit of many of these interventions remains uncertain, and their routine use is not uniformly supported by high-quality evidence.

A major challenge in interpreting treatment outcomes in ISSNHL is the relatively high rate of spontaneous hearing recovery, reported in up to one-third of affected individuals.(14) This phenomenon complicates the assessment of therapeutic efficacy and underscores the need for well-designed randomized controlled trials. Furthermore, factors such as severity of initial hearing loss, audiometric configuration, patient age, presence of vertigo, and timing of treatment initiation have been shown to influence prognosis, yet their impact on treatment selection is not consistently reflected in existing clinical guidelines.(15)

Given the variability in management strategies and the absence of a universally accepted treatment algorithm, a critical evaluation of current management protocols is warranted. This article aims to analyze and synthesize available evidence regarding the effectiveness of commonly employed therapeutic approaches for ISSNHL, with particular emphasis on corticosteroid-based regimens and adjunctive therapies. By examining outcomes, timing of intervention, and areas of consensus and controversy, this review seeks to provide a comprehensive overview that may aid clinicians in optimizing patient care and guide future research in this challenging clinical domain.

Methodology

This study was designed as a structured critical review of published literature evaluating management protocols for idiopathic sudden sensorineural hearing loss (ISSNHL). The methodology was developed to allow comparison of treatment modalities, timing of intervention, and hearing outcomes, as reflected in the results tables.

A comprehensive literature search was conducted using electronic databases including PubMed, Google Scholar, and the Cochrane Library. Articles published in English from January 2000 to December 2024 were considered. The search terms included *idiopathic sudden sensorineural*

hearing loss, *ISSNHL treatment*, *systemic steroids*, *intratympanic steroids*, *combined steroid therapy*, and *hyperbaric oxygen therapy*. Reference lists of selected articles were also manually screened to identify additional relevant studies.

Inclusion criteria:

- Involved adult patients diagnosed with ISSNHL based on standard audiometric criteria
- Evaluated one or more management modalities used in clinical practice
- Reported hearing outcomes following treatment
- Included randomized controlled trials, cohort studies, meta-analyses, or established clinical guidelines

Exclusion criteria

- Identified a specific etiology for hearing loss (e.g., acoustic neuroma, trauma, ototoxicity)
- Focused exclusively on pediatric populations
- Lacked outcome-based data

Data Extraction and Categorization

Data were extracted independently from eligible studies and categorized according to:

1. **Type of treatment modality** (systemic steroids, intratympanic steroids, combined therapy, hyperbaric oxygen therapy, and non-steroidal treatments), forming the basis of Table 1.
2. **Timing of treatment initiation**, classified as ≤7 days, 8–14 days, or >14 days from symptom onset, corresponding to Table 2.
3. **Hearing outcomes**, categorized as complete recovery, partial recovery, or no improvement, as summarized in Table 3.

Hearing recovery was defined using post-treatment pure tone audiometry, with complete recovery indicating return to baseline or near-baseline thresholds, and partial recovery indicating measurable but incomplete improvement.

Data Analysis

Given the heterogeneity of study designs and outcome measures, a qualitative and descriptive analytical approach was employed rather than a quantitative meta-analysis. Recovery rates reported across studies were synthesized and presented as approximate percentage ranges to allow meaningful comparison between different treatment strategies and timing of intervention.

Critical Appraisal

The strength of evidence for each management protocol was assessed based on study design, sample size, consistency of outcomes, and alignment with international clinical guidelines. Emphasis was placed on identifying trends in treatment efficacy and areas where evidence was limited or contradictory.

Results

Table 1: Summary of Management Modalities Used in Idiopathic Sudden Sensorineural Hearing Loss

Treatment Modality	Mode of Administration	Common Indications	Evidence Strength
Systemic corticosteroids	Oral / Intravenous	First-line therapy in most patients	High
Intratympanic corticosteroids	Transtympanic injection	Salvage therapy or steroid contraindications	High
Combined steroid therapy	Systemic + Intratympanic	Severe or profound hearing loss	Moderate–High
Hyperbaric oxygen	Adjunctive oxygen	Early presentation, severe cases	Moderate

Treatment Modality	Mode of Administration	Common Indications	Evidence Strength
therapy (HBOT)	therapy		
Antiviral agents	Oral / Intravenous	Suspected viral etiology	Low
Vasodilators / antioxidants	Oral / Intravenous	Adjunctive or empirical use	Low

Table 2: Impact of Timing of Intervention on Hearing Recovery

Time to Treatment Initiation	Hearing Recovery Rate	Clinical Outcome
≤ 7 days	High (60–80%)	Significant improvement
8–14 days	Moderate (40–60%)	Partial recovery
> 14 days	Low (20–30%)	Limited improvement
No treatment	Variable	High spontaneous recovery rate reported

Table 3: Comparative Hearing Outcomes with Different Treatment Protocols

Treatment Protocol	Complete Recovery (%)	Partial Recovery (%)	No Improvement (%)
Systemic steroids alone	40–50	25–35	20–30
Intratympanic steroids alone	35–45	30–40	20–25
Combined steroid therapy	50–65	20–30	10–20
Steroids + HBOT	55–70	15–25	10–15
Non-steroidal therapy	<30	Variable	High

Discussion

The findings summarized in this review highlight the continued predominance of corticosteroid-based therapy in the management of idiopathic sudden sensorineural hearing loss (ISSNHL), while also emphasizing the importance of early intervention and appropriate patient selection. As demonstrated in Table 1, systemic and intra tympanic corticosteroids remain the most widely used and evidence-supported treatment modalities, reflecting current international clinical practice guidelines. Their therapeutic benefit is likely attributable to their ability to reduce cochlear inflammation, suppress immune-mediated injury, and improve inner ear homeostasis.

Timing of treatment initiation emerged as a critical determinant of hearing recovery, as shown in Table 2. Patients who received therapy within the first seven days of symptom onset exhibited significantly higher recovery rates compared to those treated later. This finding reinforces the concept of ISSNHL as a medical emergency, in which delayed presentation or initiation of therapy substantially compromises prognosis. The decline in recovery rates beyond two weeks suggests that irreversible cochlear damage may occur early in the disease course, limiting the effectiveness of delayed interventions.

Comparative analysis of treatment outcomes (Table 3) further supports the superiority of combined therapeutic approaches in selected cases. Combined systemic and intratympanic steroid therapy demonstrated higher rates of complete recovery compared to either modality alone, particularly in patients with severe to profound initial hearing loss. This suggests a potential synergistic effect, where systemic steroids address widespread inflammatory processes while intratympanic delivery ensures higher local drug concentrations within the cochlea. However, variability in dosing regimens and treatment protocols across studies highlights the need for standardized guidelines.

Adjunctive hyperbaric oxygen therapy (HBOT) showed modest additional benefit when used in combination with corticosteroids, particularly when initiated early. The improved outcomes observed with HBOT may be explained by enhanced oxygen delivery to the ischemic cochlea,

supporting the vascular compromise hypothesis in ISSNHL pathogenesis. Nevertheless, its limited availability, cost, and inconsistent evidence prevent its routine use as first-line therapy.

In contrast, non-steroidal treatment modalities including antiviral agents, vasodilators, and antioxidants demonstrated low and inconsistent efficacy across studies. As indicated in Table 1 and Table 3, these therapies were associated with lower recovery rates and lack robust evidence to support routine clinical use. Their continued empirical application likely reflects uncertainty surrounding disease etiology rather than proven therapeutic benefit.

An important consideration in interpreting these results is the relatively high rate of spontaneous recovery in ISSNHL, which complicates the assessment of treatment efficacy. This underscores the necessity for high-quality randomized controlled trials with appropriate control groups to distinguish true therapeutic effects from natural recovery. Additionally, prognostic factors such as age, severity of hearing loss, and presence of vestibular symptoms should be integrated into individualized treatment decision-making.

Overall, the results of this critical analysis support early, steroid-based intervention as the cornerstone of ISSNHL management, with intra tympanic therapy and HBOT serving as valuable adjuncts in selected patients. Future research should focus on refining treatment timing, standardizing therapeutic protocols, and identifying biomarkers that may predict treatment response, ultimately improving outcomes in this challenging and unpredictable condition.

Conclusion

Idiopathic sudden sensorineural hearing loss requires prompt recognition and early intervention to optimize hearing recovery. Corticosteroid therapy remains the mainstay of treatment, with combined systemic and intra tympanic approaches offering improved outcomes in severe cases. Early initiation of therapy is the most important prognostic factor, while the role of adjunctive treatments remains limited. Standardized protocols and further high-quality studies are needed to refine management strategies.

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