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SUDDEN SENSORINEURAL HEARING LOSS: ETIOLOGY, DIAGNOSTIC CHALLENGES, AND MODERN TREATMENT APPROACHES IN OTORHINOLARYNGOLOGY

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Abstract

Sudden Sensorineural Hearing Loss (SSNHL) is an otological emergency characterized by a rapid decline in hearing function, typically occurring within 72 hours and involving a loss of at least 30 decibels across three consecutive frequencies. The condition affects individuals of all age groups and may result in significant disability if diagnosis and treatment are delayed. Although numerous etiological factors have been proposed, including viral infections, vascular compromise, autoimmune disorders, and cochlear membrane rupture, the exact cause remains unidentified in the majority of cases. Recent advances in audiological assessment, radiological imaging, and pharmacological therapy have improved clinical outcomes. Early recognition and prompt intervention are critical for hearing recovery. This article reviews the epidemiology, pathophysiology, clinical presentation, diagnostic evaluation, therapeutic strategies, and future perspectives regarding sudden sensorineural hearing loss in contemporary otorhinolaryngology practice.

Keywords: Sudden sensorineural hearing loss, cochlea, audiometry, corticosteroids, inner ear disorders, hearing impairment, otology, tinnitus, vestibular dysfunction.

1. Introduction

Sudden Sensorineural Hearing Loss represents one of the most urgent conditions encountered in otorhinolaryngology. It is defined as a rapid onset of hearing impairment developing over a period of fewer than three days and involving sensorineural deficits rather than conductive pathology. The condition is estimated to affect between 5 and 30 individuals per 100,000 population annually, although the actual incidence may be significantly higher because many mild cases remain undiagnosed.

The sudden loss of hearing can profoundly affect communication, social interaction, psychological well-being, and occupational performance. Patients frequently describe awakening with unilateral hearing loss or experiencing abrupt auditory deterioration during daily activities. In addition to hearing impairment, associated symptoms often include tinnitus, aural fullness, dizziness, and vertigo.

Despite extensive research, the precise pathogenesis of SSNHL remains incompletely understood. Several mechanisms have been proposed. Viral infections may induce inflammation within the cochlea and auditory nerve. Vascular insufficiency can lead to ischemic injury of highly sensitive cochlear

structures. Autoimmune reactions may result in damage to inner ear tissues through inflammatory pathways. Traumatic membrane rupture and genetic susceptibility have also been implicated.
The inner ear possesses limited regenerative capacity, making early intervention particularly important. Delayed treatment may result in irreversible damage to cochlear hair cells and permanent hearing impairment. Consequently, sudden sensorineural hearing loss is widely recognized as an otological emergency requiring immediate evaluation and management.
Advances in diagnostic technology have improved the ability to identify underlying pathology and exclude serious conditions such as vestibular schwannoma. Simultaneously, the development of intratympanic steroid therapy and combination treatment protocols has expanded therapeutic options. Understanding current evidence-based approaches is essential for optimizing patient outcomes.

2. Materials and Methods

This study was conducted as a comprehensive review of contemporary scientific literature addressing sudden sensorineural hearing loss. Publications were collected from major biomedical databases including PubMed, Scopus, Web of Science, Embase, and Google Scholar.
Selection criteria included clinical trials, retrospective and prospective cohort studies, systematic reviews, meta-analyses, and international guidelines published during the last fifteen years. Particular attention was given to studies investigating etiological mechanisms, diagnostic methods, prognostic indicators, and treatment effectiveness.
Articles focusing on adult and pediatric populations were evaluated. Studies with inadequate methodology, limited sample size, or insufficient clinical relevance were excluded. Information extracted from selected publications included patient demographics, symptom characteristics, audiological findings, imaging results, treatment protocols, hearing recovery rates, and long-term outcomes.
Data were analyzed through comparative evaluation of available evidence. Emphasis was placed on identifying factors associated with favorable prognosis, treatment success, and future developments in clinical management.

3. Results

The literature review demonstrated that sudden sensorineural hearing loss most commonly presents as unilateral hearing impairment. Bilateral involvement occurs infrequently but is generally associated with more severe systemic conditions and poorer prognosis.
Tinnitus was reported in approximately 70–90% of patients and represented one of the most common accompanying symptoms. Vertigo and vestibular disturbances occurred in approximately one-third of cases and were frequently associated with less favorable hearing recovery.
Audiometric evaluation consistently emerged as the cornerstone of diagnosis. Pure-tone audiometry enabled quantification of hearing loss severity and classification of audiometric patterns. Flat, ascending, descending, and profound hearing loss configurations were identified, each associated with different prognostic implications.
Magnetic resonance imaging proved valuable for excluding retrocochlear pathology, particularly vestibular schwannoma. Although tumors accounted for only a small percentage of cases, imaging remained essential for comprehensive evaluation.
Systemic corticosteroid therapy demonstrated significant therapeutic benefit when initiated within the first two weeks following symptom onset. The highest recovery rates were observed among patients receiving treatment within the first 72 hours. Intratympanic corticosteroid injections were shown to provide effective treatment for patients unable to tolerate systemic therapy and served as valuable salvage therapy in refractory cases.
Combination treatment involving systemic and intratympanic steroids frequently produced superior outcomes compared with monotherapy. Hyperbaric oxygen therapy was also associated with improved hearing recovery in selected patients, particularly when administered during the early stages of disease.
Several prognostic factors were identified. Younger age, mild-to-moderate hearing loss, absence of vertigo, and early treatment initiation correlated with improved recovery rates. Conversely, profound hearing loss, delayed presentation, advanced age, and severe vestibular symptoms were associated

with poorer outcomes.

4. Discussion

The findings of this review highlight the multifactorial nature of sudden sensorineural hearing loss and the challenges associated with determining its precise etiology. Although most cases remain classified as idiopathic, growing evidence supports the involvement of viral, vascular, and immune-mediated mechanisms.

The cochlea possesses a unique microvascular system with limited collateral circulation, making it particularly vulnerable to ischemic injury. Even brief interruptions in blood supply can result in substantial sensory cell damage. This vascular vulnerability may explain the sudden onset observed in many patients.

Inflammatory mechanisms also appear to contribute significantly to disease development. Viral infections and autoimmune responses may induce edema, oxidative stress, and cellular injury within the cochlea. The effectiveness of corticosteroid therapy supports the importance of inflammatory processes in disease pathogenesis.

The timing of treatment remains one of the most critical determinants of outcome. Multiple studies consistently demonstrate that early intervention significantly increases the likelihood of hearing recovery. Delayed therapy may allow irreversible degeneration of cochlear structures, reducing treatment effectiveness.

Recent advances in intratympanic drug delivery have transformed management strategies. Direct administration of corticosteroids into the middle ear allows high local drug concentrations while minimizing systemic adverse effects. This approach has become increasingly important for patients with diabetes mellitus, hypertension, or contraindications to systemic corticosteroid therapy.

Future research is focusing on regenerative medicine, stem cell therapy, gene therapy, and neuroprotective agents aimed at restoring damaged cochlear structures. Artificial intelligence-based predictive models may further enhance individualized treatment planning and prognostic assessment.

5. Conclusion

Sudden Sensorineural Hearing Loss is a medical emergency requiring prompt diagnosis and immediate therapeutic intervention. The condition can significantly affect quality of life and may result in permanent auditory disability if left untreated. Comprehensive evaluation involving audiological testing, clinical examination, and magnetic resonance imaging is essential for accurate diagnosis and exclusion of serious underlying pathology. Corticosteroids remain the primary treatment modality, while intratympanic therapy and hyperbaric oxygen therapy provide additional therapeutic options. Early treatment initiation, careful patient monitoring, and individualized management strategies are critical for maximizing hearing recovery. Continued advances in understanding disease mechanisms and emerging regenerative therapies offer promising opportunities for future improvements in patient care.

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