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Original Research Article

Intratympanic Dexamethasone for Sudden Sensorineural Hearing Loss: A Prospective Study on Hearing Recovery and Quality of Life Improvement

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Abstract:

Background: Sudden sensorineural hearing loss (SSNHL) is an otologic emergency characterized by rapid hearing loss. While systemic corticosteroids are a standard treatment, intratympanic dexamethasone injections offer a targeted alternative with potentially fewer systemic side effects.

Aims and Objectives: To evaluate the efficacy of intratympanic dexamethasone injection in improving hearing outcomes in patients with SSNHL.

Materials and Methods: This prospective, observational study included 50 patients with idiopathic SSNHL, aged 18 years and older, and with onset of hearing loss within the past 14 days. Patients received intratympanic dexamethasone injections (4 mg/mL) using a 25-gauge spinal needle through the tympanic membrane into the middle ear on Days 1, 3, and 5. Hearing outcomes were assessed using pure tone audiometry (PTA) and speech recognition scores at baseline, 2 weeks, 4 weeks, and 3 months post-treatment.

Results: The mean baseline hearing threshold was 80.6 ± 15.7 dB. Significant improvements were observed at 2 weeks (60.4 ± 18.3 dB, $p < 0.001$), 4 weeks (55.2 ± 16.7 dB, $p < 0.001$), and 3 months (50.1 ± 15.4 dB, $p < 0.001$). Speech recognition scores improved significantly from 42.8 ± 12.5% at baseline to 70.2 ± 12.8% at 3 months ($p < 0.001$). Patient-reported symptoms of tinnitus and vertigo decreased markedly, with no serious adverse effects reported.

Conclusion: Intratympanic dexamethasone injections significantly improve hearing thresholds and speech recognition scores in patients with SSNHL, offering a safe and effective treatment option with minimal systemic side effects.

Keywords: Sudden Sensorineural Hearing Loss, Intratympanic Dexamethasone, Hearing Outcomes, Otologic Emergency, Corticosteroid Therapy.

Introduction

Sudden sensorineural hearing loss (SSNHL) is a rapid onset of hearing loss, typically occurring within 72 hours, affecting three or more consecutive frequencies by 30 decibels or more. [1] The etiology of SSNHL is often idiopathic, though various potential causes include viral infections, vascular occlusions, and autoimmune disorders. Despite its relatively low incidence, SSNHL is considered an otologic emergency due to its significant impact on a patient's quality of life and the urgency required in treatment to maximize the chances of hearing recovery. [2, 3]

The treatment modalities for SSNHL are varied and include systemic corticosteroids, antivirals, and hyperbaric oxygen therapy, among others. [4] Systemic corticosteroids, particularly prednisone, have been the mainstay of treatment due to their anti-inflammatory properties. However, their use is often limited by systemic side effects. [5] Intratympanic corticosteroid injection has gained attention as a localized treatment option that minimizes systemic exposure while delivering high concentrations of the drug directly to the inner ear. [5, 6]

Dexamethasone, a potent corticosteroid with anti-inflammatory and immunosuppressive properties, is commonly used in intratympanic injections for SSNHL. [7] Several studies have suggested that intratympanic dexamethasone can improve hearing outcomes, particularly in patients who do not respond to systemic corticosteroids or those contraindicated for systemic therapy. [8]

This study aims to evaluate the efficacy of intratympanic dexamethasone injection in patients with SSNHL. By analyzing hearing outcomes, we aim to provide evidence of this treatment

modality's potential benefits, contributing to the optimization of SSNHL management protocols and ultimately improving patient care.

Materials and Methods

This study is a prospective, observational study to evaluate the efficacy of intratympanic dexamethasone injection in patients with sudden sensorineural hearing loss (SSNHL).

Study Population: Patients presenting with SSNHL to Department of ENT, Chirayu Medical College, Bhopal, Madhya Pradesh, were considered for inclusion. SSNHL was defined as a hearing loss of 30 decibels or more over at least three consecutive frequencies occurring within 72 hours.

Inclusion Criteria

1. Patients aged 18 years and older.
2. Diagnosis of idiopathic SSNHL confirmed by an audiologist.
3. Onset of hearing loss within the past 14 days.
4. Willingness to participate in the study and provide informed consent.

Exclusion Criteria

1. History of Meniere's disease, chronic otitis media, or other known ear diseases.
2. Previous treatment with systemic corticosteroids for the current episode of hearing loss.
3. Contraindications to dexamethasone or any components of the injection.
4. Pregnancy or lactation.
5. Inability to complete follow-up assessments.

Treatment Protocol: Patients received intratympanic dexamethasone injections (4 mg/mL). The injection was administered using a 25-gauge spinal needle through the tympanic membrane into the middle ear under a microscope. The protocol involved three injections over one week (Days 1, 3, and 5).

Audiological Assessments

1. **Baseline Assessment:** Pure tone audiometry (PTA) was performed at the time of diagnosis to document the degree of hearing loss.
2. **Follow-up Assessments:** To evaluate hearing improvement, PTA was repeated at 2 weeks, 4 weeks, and 3 months post-treatment. Hearing gain was calculated as the difference between the baseline and follow-up PTA thresholds.
3. **Speech Audiometry:** Speech recognition scores were also measured at each follow-up visit.

Outcome Measures

1. **Primary Outcome:** Improvement in hearing thresholds at 2 weeks, 4 weeks, and 3 months post-treatment.
2. **Secondary Outcomes:** Changes in speech recognition scores, patient-reported outcome measures (e.g., tinnitus, vertigo), and incidence of adverse effects related to the injection.

Statistical Analysis: Data were analyzed using SPSS software (version 25]). Continuous variables were expressed as mean ± standard deviation (SD) and compared using paired t-tests. Categorical variables were expressed as percentages and analyzed using the chi-square test. A p-value < 0.05 was considered statistically significant.

Results

Patient Demographics: A total of 50 patients with SSNHL were enrolled in the study. The mean age of the patients was 45.3 ± 12.4 years, with a male-to-female ratio of 1:1. The baseline characteristics of the patients are summarized in Table 1.

Table 1: Baseline Characteristics of Patients

Characteristic	Value (n=50)
Age (years)	45.3 ± 12.4
Gender (M/F)	25/25
Duration of hearing loss	7.2 ± 3.5 days
Baseline hearing threshold (dB)	80.6 ± 15.7
Baseline speech recognition (%)	42.8 ± 12.5

Hearing Improvement: The mean hearing threshold at baseline was 80.6 ± 15.7 dB. Following intratympanic dexamethasone injections, significant improvements were observed in hearing thresholds at all follow-up points. At 2 weeks, the mean hearing threshold improved to 60.4 ± 18.3 dB ($p < 0.001$). At 4 weeks, it improved to 55.2 ± 16.7 dB ($p < 0.001$). At 3 months, the mean hearing threshold was 50.1 ± 15.4 dB ($p < 0.001$). These improvements are summarized in Table 2.

Table 2: Hearing Thresholds Over Time

Time Point	Mean Hearing Threshold (dB)	Improvement (dB)	p-value
Baseline	80.6 ± 15.7	-	-
2 Weeks	60.4 ± 18.3	20.2	<0.001
4 Weeks	55.2 ± 16.7	25.4	<0.001
3 Months	50.1 ± 15.4	30.5	<0.001

Speech Recognition Scores: Speech recognition scores showed significant improvements over time. The baseline speech recognition score was 42.8 ± 12.5%. At 2 weeks, the score improved to 58.3 ± 14.2% ($p < 0.001$), at 4 weeks to 65.7 ± 13.1% ($p < 0.001$), and at 3 months to 70.2 ± 12.8% ($p < 0.001$). These results are detailed in Table 3.

Table 3: Speech Recognition Scores Over Time

Time Point	Mean Speech Recognition (%)	Improvement (%)	p-value
Baseline	42.8 ± 12.5	-	-
2 Weeks	58.3 ± 14.2	15.5	<0.001
4 Weeks	65.7 ± 13.1	22.9	<0.001
3 Months	70.2 ± 12.8	27.4	<0.001

Patient-Reported Outcomes: Patients reported improvements in tinnitus and vertigo symptoms. At baseline, 60% of patients reported tinnitus, which decreased to 30% at 3 months. Vertigo was reported by 40% of patients at baseline, reducing to 15% at 3 months.

Adverse Effects: No serious adverse effects were reported. Mild transient discomfort at the injection site was noted in 10% of patients, which resolved within a few hours.

Discussion

This study demonstrates that intratympanic dexamethasone injections significantly improve hearing thresholds and speech recognition scores in patients with sudden sensorineural hearing loss (SSNHL). The observed improvements are consistent with those reported in previous studies, further validating the efficacy of this treatment modality.

Our findings align with Rauch et al. (2011) [9], who conducted a randomized controlled trial comparing intratympanic dexamethasone to oral prednisone. Their study found that patients receiving intratympanic dexamethasone experienced significant hearing improvement, mainly when treated early during SSNHL. Similarly, our study shows early intervention with intratympanic dexamethasone can lead to substantial auditory recovery.

A meta-analysis by Han et al. (2016) [10] evaluated the effectiveness of intratympanic corticosteroid therapy for SSNHL and concluded that it is beneficial as both primary and salvage therapy. Our results corroborate this, as significant improvements were noted in hearing thresholds and speech recognition scores at 2 weeks, 4 weeks, and 3 months post-treatment.

Furthermore, Chen et al. (2013) [11] reported that intratympanic dexamethasone injections resulted in a mean hearing improvement of 25.7 dB in their cohort. Our study observed a mean hearing improvement of 20.2 dB at 2 weeks, 25.4 dB at 4 weeks, and 30.5 dB at 3 months, indicating a consistent trend of progressive hearing recovery over time.

The reduction in patient-reported symptoms such as tinnitus and vertigo further supports the positive impact of intratympanic dexamethasone on overall quality of life. Slattery et al. (2005) [12] reported similar symptom relief, noting that patients experienced significant reductions in tinnitus and vertigo following intratympanic steroid treatment.

Clinical Implications: The results of our study underscore the importance of early intervention in SSNHL. Intratympanic dexamethasone provides a targeted therapeutic approach that minimizes systemic side effects while delivering high concentrations of the drug directly to the inner ear. This treatment should be considered, particularly for patients contraindicated for systemic corticosteroids or those who have not responded to initial systemic therapy.

Limitations: While our study demonstrates significant benefits, it has limitations. The sample size is small, and the study lacks a control group receiving a placebo or alternative treatment. Future studies with larger cohorts and randomized controlled designs are needed to validate these findings further and refine treatment protocols.

Conclusion

Intratympanic dexamethasone injections offer a promising therapeutic option for patients with SSNHL. They lead to significant improvements in hearing thresholds and speech recognition scores, along with reduced symptoms of tinnitus and vertigo. In conjunction with existing literature, our findings support using this modality as an effective and safe treatment for SSNHL.

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