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ORIGINAL ARTICLE

Intratympanic depomedrol or oral prednisone. A comparative analysis in idiopathic sudden sensorineural hearing loss (SSNHL).

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ABSTRACT… Objective: To compare the efficacy of systemic steroids and intratympanic steroid therapy in terms of hearing outcomes in patients diagnosed with sudden sensorineural hearing loss. **Study Design:** Prospective Non-randomized Clinical study. **Setting:** Department of Otorhinolaryngology, Shifa International Hospital, Islamabad. **Period:** November 2024 to November 2025. **Methods:** All patients diagnosed with SSNHL were enrolled consecutively and categorized into two groups based on treatment received: oral or intratympanic steroids. All patients were followed. Pre-treatment hearing threshold and post-treatment hearing threshold after completion of treatment and repeat audiogram within 2 months after treatment were assessed. **Results:** Twenty-nine patients were included (12 oral, 17 intratympanic). There was no significant difference in hearing threshold improvement between oral and intratympanic steroid therapy (Mann–Whitney U = 78.0, p = 0.303), and post-treatment hearing recovery according to Siegel's criteria was comparable between groups. Multivariable analysis identified longer symptom duration, history of mumps, associated vertigo, and asthma as significant negative predictors of hearing improvement, independent of treatment modality. **Conclusion:** Oral and intratympanic steroid therapy demonstrated comparable effectiveness in the treatment of idiopathic sudden sensorineural hearing loss. Prognostic factors, particularly delayed presentation and associated vertigo, history of mumps and history of asthma, appear to play a more decisive role in hearing recovery than the route of steroid administration.

Key words: Intratympanic Steroids, Oral Steroids, Sudden Hearing Loss, Sensorineural.

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INTRODUCTION

Sudden hearing loss is a distressing condition characterized by rapid onset of hearing impairment often prompting urgent medical evaluation. It is frequently accompanied by tinnitus and vertigo.[1] The latter occurs in 30-60 % of the cases and is associated with poorer prognosis.[2,3,4] Tinnitus is usually present and it may persist and cause significant discomfort.

The National Institute on Deafness and Other Communication Disorders (NIDCD) defines sudden sensorineural hearing loss (SSNHL) as a decline of at least 30 dB in three or more consecutive frequencies on an audiogram within a 72-hour period.[5]

Worldwide, the incidence of SSNHL is estimated to be 5 to 20 cases per 100,000 individuals each year.[6] In Pakistan, population-based data are limited. However, available reports indicate a prevalence of 3.7%, highlighting the need for further research into this condition.[7]

Patients with SSNHL face immediate problems with understanding conversation on the involved side, generalized difficulty understanding with background noise and difficulty in sound localization which not only affects the quality of life but poses safety risks. Prompt diagnosis, timely initiation of therapy, patient counselling, and targeted rehabilitation strategies are therefore essential components of management.

Despite established clinical practice guidelines for idiopathic sudden sensorineural hearing loss (SSNHL), controversies persist regarding optimal management. Systemic corticosteroids, most commonly oral prednisone, are widely considered as first-line therapy[8], but their use is limited in patients with poorly controlled diabetes, uncontrolled hypertension, peptic ulcer disease, glaucoma, tuberculosis, elderly or prior psychiatric

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reactions with steroids. Intratympanic steroid therapy provides targeted delivery with minimal systemic exposure and is effective in patients with contraindications to systemic steroids or as salvage therapy, demonstrating clinically meaningful improvements in hearing outcomes.[9] Studies also suggest that combination therapy (intratympanic methylprednisolone plus oral steroid) may improve hearing recovery compared to systemic steroids alone, and that intratympanic therapy alone may be non-inferior to oral therapy.[10,11] Despite these findings, comparative evidence remains inconclusive, highlighting the need for direct studies evaluating the relative effectiveness and safety of oral versus intratympanic corticosteroids in SSNHL.

Our prospective, non-randomized clinical study was conducted to compare the efficacy of oral versus intratympanic steroid therapy in patients diagnosed with SSNHL within the Pakistani population.

METHODS

This prospective clinical study was conducted at a tertiary care hospital in Pakistan after obtaining approval from the Institutional Review Board (IRB#190-24(7-11-24). All patients above 15 years of age presenting with SSNHL and met NIDCD criteria were included i.e. (a) hearing loss is sensorineural in nature, (b) occurs within a 72-hour window, and (c) consists of a decrease in hearing of 30 decibels affecting at least 3 consecutive frequencies.

Patients with identifiable causes of sensorineural hearing loss were excluded. Specifically individuals with Ménière's disease, acoustic neuroma, chronic otitis media, prior ear surgery, autoimmune inner ear disorders, or hearing loss attributable to trauma or excessive noise exposure were not enrolled.

Patients meeting the diagnostic criteria were divided into two groups based on the treatment they were receiving. Group A comprised patients treated with systemic corticosteroids (prednisone 1 mg/kg/day, maximum 60 mg/day, for 10 days followed by a taper at 0.5 mg/kg/day for two days and 0.25 mg/kg/day for another two days), with total 14 days of drug therapy. Audiometric reassessment was performed upon completion of therapy.

Group B consisted of patients who received intratympanic steroid injections (Depo-Medrol 40 mg/mL, administered as three injections at 5-day intervals), followed by repeat audiometric evaluation. For intratympanic injection administration, the patient was taken to an ENT procedure room equipped with an ENT microscope. The patient was placed in a supine position with head tilted away from the affected ear. The external auditory canal was cleaned to visualize the whole tympanic membrane. A small piece of cotton dipped in 25% phenol solution was touched to the anteroinferior quadrant of tympanic membrane to anesthetize it. A 3-mL syringe with 26 gauge spinal needle attached was used to deliver the medicine to the tympanic cavity via tympanic membrane. After the medicine was injected, the patient was asked to turn to one side with the injected ear on the top and was asked to lie down in that position for 20 minutes and not swallow during that time period.

Pre-treatment PTA was performed at presentation. Post-treatment pure-tone audiometry was conducted at the conclusion of the treatment; followed by a repeat PTA within 2 months after treatment completion. The primary outcome measure was the change in PTA threshold at the 2-month follow up compared with baseline PTA. Hearing thresholds were recorded for all participants. Audiometric outcomes were analyzed using appropriate statistical methods to compare within-group and between-group changes in hearing thresholds. Results were interpreted to identify significant differences in hearing improvement between the two treatment modalities and were presented using descriptive and comparative statistical summaries. Diagnosis, treatment, and follow-up were performed in accordance with the clinical practice guidelines for SSNHL.[12]

RESULTS

There were 29 patients in the final sample – 12 received oral steroids and 17 received intratympanic (IT), as shown in Table-I below. Along with basic demographic information, their symptoms and comorbidities were also recorded.

Due to the non-parametric distribution of the sample, a Mann-Whitney U test was performed to compare

the difference in hearing thresholds between the two treatment modalities (Oral vs IT). The route of administration of steroids did not significantly impact the difference in hearing threshold before and after treatment. (U = 78.00, p = 0.303).

Next, we used a multiple linear regression model to identify the predictive factors for hearing threshold change pre-administration and post-administration (see Table-II). A history of mumps (B = -50.881, 95% CI -71.89 to -29.87, p < 0.001) and the number of days of symptoms (B = -18.144, 95% CI -28.12 to -8.17, p = .001) were most significantly predictive. Associated vertigo (B = -14.87, 95% CI -25.87 to -3.87, p=.011) and asthma as a co-morbidity (B = -23.798, 95% CI -44.06 to -3.54, p = .024) were also significant factors.

Finally, an ordinal regression was run to compare post-treatment Siegel criteria hearing recovery between the two groups, controlling for age and gender. Intratympanic steroid administration was marginally better, however, this was not clinically significant (OR 0.69, 95% CI [-1.97 to 1.23], p = 0.653).

TABLE-I

Demographic and clinical characteristics of the participants

Characteristic		All patients (n = 29)	Oral (n = 12)	IT (n = 17)
Age ± SD (years)		40.4 ± 16.6	38.2 ± 16.1	41.9 ± 17.2
Sex	Male	16 (55%)	6 (50%)	10 (59%)
	Female	13 (45%)	6 (50%)	7 (41%)
Side	Right	13 (45%)	4 (33%)	9 (53%)
	Left	16 (55%)	8 (67%)	8 (47%)
Symptomatic Days	≤7	11 (38%)	3 (23.1%)	1 (7.7%)
	>7	18 (62%)	10 (76.9%)	12 (92.3%)
Associated Vertigo	Yes	13 (45%)	6 (50%)	7 (41%)
	No	16 (55%)	6 (50%)	10 (59%)
Associated Tinnitus	Yes	19 (66%)	9 (75%)	10 (59%)
	No	10 (34%)	3 (25%)	7 (41%)
Diabetes Mellitus	Yes	4 (14%)	1 (8%)	3 (18%)
	No	25 (86%)	11 (92%)	14 (82%)
Hypertension	Yes	5 (21%)	1 (8%)	4 (23%)
	No	24 (79%)	11 (92%)	13 (77%)
Asthma	Yes	2 (7%)	1 (8%)	1 (6%)
	No	27 (93%)	11 (92%)	16 (94%)
History of Mumps	Yes	2 (7%)	0 (0%)	2 (12%)
	No	27 (93%)	12 (100%)	15 (88%)

TABLE-II

Multiple linear regression model results for oral v intratympanic steroid administration *p <0.05 ***p ≤0.001

Factor	B	SE	β	t	P-Value
Oral v Intratympanic steroids	.608	4.169	.016	.146	.886
Age (≥18 vs <18 years)	12.436	9.564	.170	1.30	.211
Gender (Male v Female)	10.886	5.249	.292	2.074	.054
Affected side (Right v Left)	-1.748	4.901	-.047	-.357	.726
Diabetes Mellitus (Yes v No)	-12.694	9.238	-.236	-1.374	.187
Hypertension (Yes v No)	9.945	8.104	.202	1.227	.236
Asthma (Yes v No)	-23.798	9.604	-.325	-2.478	.024*
History of mumps (Yes v No)	-50.881	9.958	-.694	-5.109	<.001***
Days of symptoms (Over v Under 7)	-18.144	4.730	-.474	-3.836	.001***
Associated vertigo (Yes v No)	-14.867	5.215	-.398	-2.851	.011*
Associated tinnitus (Yes v No)	10.817	5.622	.277	1.924	.071

DISCUSSION

This study assessed the efficacy of oral steroids compared to intratympanic steroids for treating idiopathic sudden sensorineural hearing loss (SSNHL). The lack of a significant difference in hearing change between oral and intratympanic steroid groups might be due to the small sample size, which limited the ability to identify smaller treatment effects. This limitation stemmed from the study design. Institutional rules only allowed for prospective enrollment, which limited the number of patients included. Similar issues have been noted in other single-center studies, especially for conditions with low incidence and limited treatment opportunities.

The baseline demographic and clinical characteristics of the two groups were largely comparable. Notably, however, a higher proportion of patients in the intratympanic steroid group presented after more than seven days of symptom onset. Given that, delayed initiation of therapy is a well-established negative prognostic factor in sudden sensorineural hearing loss[13,14,15], this imbalance may have attenuated the apparent benefit of intratympanic treatment and should be taken into account when interpreting the study outcomes.

Furthermore, multivariable regression analysis suggested that factors related to disease presentation exerted a greater influence on hearing recovery than the route of steroid administration itself. In particular, symptom duration exceeding seven days emerged as a strong predictor of poorer hearing improvement, reinforcing existing evidence that early intervention is critical for optimal recovery.[13,14,15] A history of mumps infection was the most significant negative predictor, hinting that past viral damage to the inner ear may lead to more serious or irreversible cochlear harm. This is consistent with the available data, as mumps virus is known to cause direct neural and cochlear injury leading to severe and permanent sensorineural hearing loss.[16,17,18] The small number of affected patients should be considered when interpreting the finding. Supporting this, a multicentered study analysing patients with SSNHL from 1987 to 2016 diagnosed with mumps associated-hearing loss demonstrated that only 3.4% of patients improved with treatment.[19]

Associated symptoms like vertigo and co-morbids like asthma were also linked to lower hearing recovery, supporting earlier observations that vestibular problems and underlying inflammation may indicate more severe inner ear issues. The presence of vertigo at symptom onset is frequently correlated with poorer outcomes in hearing restoration.[2,3,4] Although direct evidence linking asthma to poorer hearing recovery after SSNHL treatment is not yet established, population-based studies have shown that asthma is associated with increased incidence (or risk) of SSNHL[20] Inflammatory processes are known to affect recovery from SSNHL, which provides an understandable explanation for the adverse impact of asthma observed in our patients.[21]

Ordinal regression analysis of post-treatment Siegel recovery categories showed a non-significant trend towards intratympanic steroids after adjusting for age and gender. Although this trend did not reach statistical or clinical significance, the small sample size might again cause difficulty extrapolation on to the general population, highlighting the problems due to the small sample size.

The results of this study mostly align with previous research. Swachia et al. found similar improvements in hearing with both oral and intratympanic steroids in a prospective randomized study, with no meaningful difference between the two groups.[8] The significant non-inferiority trial by Rauch et al. showed that intratympanic methylprednisolone was as effective as oral prednisone, with similar improvement after two months, closely matching the current study's results.[6] Larger retrospective and multicenter studies did not show clear superiority for either treatment, reporting similar hearing gains with systemic, intratympanic, and combined therapy.[22,23] Recent randomized and comparative studies have confirmed significant hearing improvement with both oral and intratympanic steroids, without a statistically significant difference in overall effectiveness.[24,25]

Systematic reviews conducted by Mirsalehis and Zhao showed similar results, Mirsalehi et al. discovered no significant difference in PTA improvement or recovery rates between

intratympanic and systemic steroids.[26] Zhao et al. also reported no difference in overall effectiveness, although intratympanic therapy had a slightly higher complete recovery rate.[27] In contrast, Qiang et al. noted a modest advantage for intratympanic therapy; however, their subgroup analyses did not show consistent benefits when based on initial hearing severity.[28]

Overall, these findings suggest that mode of administration of steroids may be less important than factors specific to the patient and their condition, such as timing of treatment, initial severity, and other clinical aspects. This study contributes to the growing evidence that intratympanic steroid therapy can achieve results similar to systemic steroids in the initial treatment of SSNHL.

In addition to the choice of steroid delivery route, growing evidence indicates that the management of SSNHL should extend beyond a comparison of oral and intratympanic therapy. Clinical outcomes are strongly influenced by factors such as the degree of hearing loss at presentation, associated vestibular symptoms, and delays in treatment initiation, suggesting that therapy should be tailored accordingly.[10] Several studies have evaluated adjunctive interventions, most notably hyperbaric oxygen therapy, which has been shown to provide additional hearing benefit when combined with corticosteroids, particularly in patients with moderate to severe hearing loss and when initiated early in the disease course.[12] Other approaches explored in the literature include combined systemic and intratympanic steroid regimens, modified intratympanic dosing protocols, and individualized treatment strategies based on audiometric patterns and patient comorbidities.[10] Collectively, these findings support the need for future studies to focus on personalized treatment frameworks that integrate disease severity, timing, and adjunctive therapies rather than relying solely on direct comparisons between treatment modalities.[10,12]

CONCLUSION

In summary, this study found no significant difference between oral and intratympanic steroids for treating idiopathic sudden sensorineural hearing loss. Recovery appeared to be influenced more by factors such as duration of symptoms, presence of vertigo, associated asthma, or a history of mumps. Larger multicenter studies are needed to determine the most effective treatment strategies and identify which patients benefit most from each approach.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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