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Our 5-Year Clinical Experience in Idiopathic Sudden Sensorineural Hearing Loss

ABSTRACT

Background: The aim of the study was to determine which steroids effectively treat idiopathic sudden sensorineural hearing loss (ISSNHL).

Methods: Records of patients who were followed up for ISSNHL diagnosis between 2014 and 2018 were retrospectively analyzed. The efficacy of different steroids (systemic, intratympanic, and systemic + intratympanic) in the treatment of ISSNHL was evaluated. Eighty-nine patients diagnosed with ISSNHL were included in the study. In addition to steroid treatment, all groups received standard treatment. It was observed that 43 patients received steroid treatment orally, 17 received intratympanic, and the remaining 23 received combination treatment. The recovery was evaluated according to the modified Siegel's criteria.

Results: The mean age of the patients was 50.2 ± 14.7 years; 60% (n = 53) were male, and 40% (n = 36) were female. The median values of pure tone averages before treatment were 43.41 ± 17.92 dB, 53.9 ± 14.70 dB, and 51.86 ± 12.76 dB in the systemic steroid, intratympanic steroid, and combined treatment groups, respectively. After treatment, hearing levels improved by 22.62 ± 15.87 dB, 38.4 ± 18.83 dB, and 34.26 ± 17.98 dB, respectively. The treatment efficacy of the groups was statistically significant in terms of pure tone averages ($P < .05$). The improvement rate with systemic treatment was 4.25 times higher than that of intratympanic treatment. There was no significant difference between patients who received intratympanic treatment and those who received combination therapy ($P = .55$). There was no significant difference between patients receiving systemic and combination treatments ($P = .058$).

Conclusion: Systemic steroids are more effective than intratympanic treatment for ISSNHL. This study showed that systemic steroids were more effective during initial treatment.

Keywords: Sensorineural hearing loss, intratympanic, modified Siegel, steroid, sudden hearing loss

INTRODUCTION

Idiopathic sudden sensorineural hearing loss (ISSNHL) is one of the clinical conditions that require prompt diagnosis and treatment during emergency and outpatient clinic visits because it is one of the conditions related to ear, nose, and throat diseases. The exact cause of ISSNHL, which occurs in the cochlear hearing nerve or central auditory pathway, remains unknown. Idiopathic sudden sensorineural hearing loss is defined as sudden onset hearing loss with a threshold value of 30 dB or more in sensorineural features at least 3 consecutive frequencies on audiological evaluation, occurring within 3 days or less. Bilateral occurrence is approximately 3%, which may rarely occur sequentially in the contralateral ear.[1-4] The incidence rate in the United States in 2006-2007 was 27 per 100 000, but the incidence rate became more pronounced with age; for example, 7 times more cases were reported in those aged over 18 years. They reported that it is more common in men aged >65 years of age.[3,4] Only 10% of the patients have an underlying pathogenesis that can identify the cause of the disease, and the most common reason is idiopathic. Although the vascular theory that assumes among the reasons considered in the etiopathogenesis of ISSNHL, conditions such as viral infections, neurotoxicity, inflammation, trauma, and autoimmunity may also play a role.[2,4,5]

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Many studies have reported that spontaneous recovery rates in patients with ISSNHL vary between 30% and 65%. The actual rate is unknown, as many spontaneously recovering patients require records during the diagnosis and treatment stages. Therefore, the boundary between the effectiveness of medical treatment during the diagnostic process and the rate of spontaneous recovery remains controversial.[3] When presenting with sudden hearing loss (SHL), it is recommended to exclude the causes of conductive hearing loss. After a comprehensive otolaryngology examination, the diagnosis should be confirmed using pure tone audiometry, speech audiometry, and tympanometry tests.[1] They recommended performing magnetic resonance imaging (MRI) to evaluate the inner and middle ear structures for a detailed evaluation of the patient's diagnosis within the first 2 weeks.[6]

There is no standard treatment protocol; however, dozens of treatment options have been reported. Antivirals, anticoagulants, vitamins, anti-inflammatory drugs, vasodilators, and hyperbaric oxygen therapy, alone or in combination, are recommended based on these studies. The use of corticosteroids is the most effective treatment method, and it has been suggested that steroid treatment occurs within the first 45 days of diagnosis. The route of administration of steroids can vary; they may be in the form of systemic, intratympanic, or combined treatments. In the past, systemic steroids have been used. However, the intratympanic route has become popular because of its low potential for side effects and direct effects on the inner ear.[1,3]

This retrospective study aimed to evaluate the effectiveness and superiority of different administration methods of steroids, one of the most effective treatments for ISSNHL, based on the results obtained from our clinic's patients regarding the literature review.

MATERIAL AND METHODS

Patients

This study included patients who were treated at Niğde Ömer Halisdemir University Training and Research Hospital Ear, Nose, and Throat clinic between 2014 and 2018 and were diagnosed with ISSNHL. This retrospective study was conducted after the decision of the Ethics Committee of Niğde Ömer Halisdemir University Faculty of Medicine (2020/64). This study analyzed the types of treatment provided, the effectiveness of the treatment, and demographic data. In addition, the relationship between the 2 was analyzed. We obtained an informed consent form by providing patients with detailed information about the study. We studied laboratory values to exclude other possible conditions in the etiology of SHL.

Biochemical tests, complete blood count, viral serology, thyroid function tests, and autoimmune parameters of the patients were examined. We evaluated the patients' temporal and cranial MRI scans to exclude the causes of hearing loss originating from the central and temporal regions. The inclusion criteria in this study were as follows: 18 years of age or older, standards for SHL, no etiologic cause, and receiving treatment at our clinic. Steroids were administered to patients via the systemic oral route, intratympanic, or combined form. We examined patients who received steroid treatment in 3 different groups. Steroid therapy was terminated by reducing the oral dose of 1 mg/kg methylprednisolone to 10 mg every 3 days. Intratympanic treatment was administered twice weekly for 3 weeks with 6 or 4 mg/1 mL dexamethasone. Intratympanic steroid treatment is administered to patients who cannot achieve the desired improvement target despite systemic steroid treatment or who do not respond to treatment.

In addition, all patients received betahistine dihydrochloride, piracetam, vitamin B complex, proton pump inhibitors, dietary recommendations, and noise protection advice.

Intratympanic Injection and Audiometric Evaluation

The patient was in the supine position for intratympanic injection, with the ear being injected and rotated 45° toward the unaffected ear. After applying 10% lidocaine as a topical local anesthetic, 4 mg/1 mL dexamethasone was infused into the middle ear via a 27-gauge dental needle through the posterior–inferior quadrant of the tympanic membrane using an otoscope. After the injection, the patients were instructed to remain in the same position, not speak, and not swallow for 30 minutes. Audiological evaluation included pure tone audiometry, tympanometry, and acoustic reflex measurements. Pretreatment and posttreatment audiological evaluations were conducted based on pure tone averages at frequencies of 250, 500, 1000, 2000, 4000, and 8000 Hz. We performed follow-ups with pure tone audiometric assessments in the first, first, third, and sixth months. In this study, pure tone threshold averages were measured after 6 months for the control. We performed audiological evaluation measurements using an Amplid 321 model device. The hearing improvement ratio was assessed according to the modified Siegel's criteria[4] (Table 1).

Statistical Analysis

The Statistical Package for the Social Sciences Statistics software, version 23 (IBM SPSS Corp.; Armonk, NY, USA), for Windows was used for the statistical analysis. The Mann–Whitney *U*-test was used to calculate the mean of the independent groups. The Wilcoxon rank test was used to compare patients' previous and subsequent hearing tests; comparisons of the treatment groups were made using univariate logistic regression analysis. Multivariate logistic regression analysis was used to adjust for age and sex. Statistical significance was set at $P < .05$.

MAIN POINTS

- In this study, systemic steroids were more effective than in the other 2 groups.
- The efficacy rate of steroids varies according to the methodologies used in each study.
- The most effective drug that can be administered to treat sudden hearing loss is steroids.
- The intratympanic route is recommended to avoid systemic side effects of steroids

RESULTS

The mean age of the 89 patients included in the study was 50.2 ± 14.7 years. The female-to-male ratio was 36:53, and

Table 1. Evaluation Levels of Pretreatment and Posttreatment Hearing Levels According to Modified Siegel's Criteria

Staging According to the Pure Tone Threshold Average Before Treatment
Grade 1—Average hearing thresholds ≤25 dB HL
Grade 2—Average hearing thresholds 26-40 dB HL
Grade 3—Average hearing thresholds 46-75 dB HL
Grade 4—Average hearing thresholds 76-90 dB HL
Grade 5—Average hearing thresholds >90 dB HL
Evaluation Levels According to Pure Tone Threshold Average After Treatment
Complete recovery: Final hearing level ≤25 dB HL
Partial recovery: >15 dB more hearing gain and final hearing levels between 26 dB and 45 dB
Slight improvement: >15 dB more hearing gain and absolute hearing levels between 46 dB and 75 dB
No improvement: <15 dB more hearing gain and whole hearing levels between 76 dB and 90 dB
Total hearing loss: Final hearing levels >90 dB

the percentage of the right ear to the left ear was 47 : 42. Most patients in the treatment group were in the systemic steroid group (43). There were 23 patients in the combined group. In this study, 17 patients were in the intratympanic injection group, and 6 did not want any treatment. No permanent sequelae were observed in any patient when any of the 3 steroid treatments were administered. Of the 40 patients who received intratympanic administration, none experienced permanent complications related to the tympanic membrane from the injection ion. While 46 of the patients had complete resolution, 12 had partial recovery. The number of patients who recovered and did not recover were 58 and 31, respectively. In this study, according to the modified Siegel's criteria, 1 patient had grade 1, 28 had grade 2, and 50 had grade 3. The details of the treatment groups are presented in Table 2.

Hearing tests of the patients before and 6 months after treatment were compared using the Wilcoxon test. Statistically, significant improvement was observed in the groups that received intratympanic injection, systemic therapy, and combination therapy ($P = .005$, $P = .000$, and $P = .001$, respectively) and progress events in the untreated group ($P = .34$) (Table 3). We compared the treatment groups according to their recovery ratio status. Patients with ISSNHL who received systemic steroid injection therapy showed a statistically 4.25 ($P = .01$, CI: 1.27-14.15) times higher recovery rate than those who received intratympanic steroid therapy. No significant difference existed between those who received intratympanic and combined therapy ($P = .55$, OR 1.46, CI: 0.41-5.15). The systemic and combination treatment groups were compared, and no significant differences were found ($P = .058$, OR 0.34, CI: 0.11-1.03). The comparison of those receiving intratympanic and systemic treatment with multivariate logistic regression analysis was adjusted for age and sex, and it was observed that the significant relationship continued similarly ($P = .02$, OR 4.15, CI: 1.16-14.74) (Table 4).

Treatment recipients were classified according to the modified Siegel's criteria. The recovery rates were 90% for grade 1, 69% for grade 2, and 60% for grade 3. The overall cure rate was 66% (n = 55), and the rate of non-healing patients was 34% (n = 34 and those not taking steroid therapy). Of the population who received treatment, 53% (n = 44) recovered fully and 13% (n = 11) partially (Table 5). In the untreated population, 1 patient with grade 1 disease showed no recovery. Two patients were classified as grade 2, 1 fully recovered, and 1 did not. In grade 3, there was 1 fully recovered, 1 partly recovered, and 1 no recovery.

DISCUSSION

The diagnosis of ISSNHL is an emergency that is a frequent reason for admission to otolaryngology clinics, with an incidence of 27 per 100 000 in the United States. They reported that ISSNHL is more common in males and that it increases with age. Osafo et al[7] reported that SNL diagnosis is more common in male patients (56.8%), and the right ear is more affected by this status (58.1%) than the left ear. In addition, in this study, similar to the previous study, male patients were more commonly affected (59.6%) and had more frequently observed involvement of the right ear (52.8%). Since the etiopathogenesis of ISSNHL still needs to be clearly understood, it sometimes remains undiagnosed. Some cases may show spontaneous improvement; however, the incidence rate remains unknown. Vascular occlusion, viral infection, and labyrinth membrane rupture are among the most frequent causes. Advanced age, vertigo, and high-frequency hearing loss on audiological examination worsened the prognosis of SHL. However, both treatments are controversial, and no definitive curative treatment exists for each case.[8] Several treatment options have been reported for ISSNHL. The most well-known and widely used group of drugs worldwide is steroids for ISSNHL treatment. Steroids can be administered

Table 2. The Demographic of the Study Population and the Treatment Groups

	Intratympanic n = 17 (19%)	Systemic n = 43 (48%)	Combination n = 23 (26%)	None n = 6 (7%)	All n = 89 (100%)
Age (mean)	53.9 ± 3.0	47.7 ± 2.6	50.0 ± 2.2	59.5 ± 3.5	50.2 ± 14.7
Gender (female/male)	6/11	15/28	12/11	3/3	36/53
Right/left	8/9	20/23	15/8	4/2	47/42
Complete recovery	5 (10.9%)	32 (69.6%)	7 (15.2%)	2 (4.3%)	46
Partial recovery	3 (25.0%)	2 (16.7%)	6 (50.0%)	1 (8.3%)	12
No recovery	9 (29.0%)	9 (29.0%)	10 (32.3%)	3 (9.7%)	31
Grade 1	1 (9.1%)	8 (72.7%)	1 (9.1%)	1 (9.1%)	11
Grade 2	4 (14.3%)	17 (60.7%)	5 (17.9%)	2 (7.1%)	28
Grade 3	12 (24.0%)	18 (36.0%)	17 (34.0%)	3 (6.0%)	50

Table 3. The Comparison of Audiology Results Before and After Treatment

	Before	After	*P*
Intratympanic	53.9 ± 14.70	38.4 ± 18.83	.005*
Systemic	43.41 ± 17.92	22.62 ± 15.87	.000*
Combination	51.86 ± 12.76	34.26 ± 17.98	.001*
None	51.6 ± 17.72	40.3 ± 19.0	.34

*Significant values $P < .05$.

Table 4. Comparison of the Success of Treatment Methods

	Odds Ratio (95% CI)	*P*
Intratympanic vs. systemic	4.25 (1.27-14.15)	.01*
Intratympanic vs. combination	1.46 (0.41-5.15)	.55
Systemic vs. combination	0.34 (0.11-1.03)	.058
	Odds Ratio**	***P***
Intratympanic and systemic	4.15 (1.16-14.74)	.02*

*Significant values $P < .05$.
**Adjusted by age, gender.

systemically, intratympanically, or in combination. Intratympanic steroid therapy is the preferred treatment modality for SHL patients with diabetes mellitus and similar risk factors to avoid undesirable systemic side effects. In addition, systemic steroid treatment is limited in cases where the efficacy of the treatment on the process of SHL is limited, and combination therapy is recommended as an option by adding intratympanic steroid treatment.[9-11]

We used similar treatment modalities in our clinic for the diagnosis of ISSNHL. We started our treatment by explaining the effects of systemic, intratympanic, and combined steroid therapies on the recovery process of ISSNHL, as well as the effectiveness of recovery during treatment and the possibility of switching to additional treatment methods. We also informed the patients about the side effects of treatment and included their decisions regarding the choice of treatment. Considering these factors, we administered systemic steroid therapy to 43 patients, combined steroid therapy to 23 patients, and intratympanic therapy to only 17 patients, while 6 patients did not want steroid treatment. Our patients' pretreatment and posttreatment hearing results who received intratympanic, systemic, and combined steroid therapies ($P = .005$, $P = .000$, and $P = .001$, respectively) showed a statistically significant improvement. The treatment of patients who received only systemic steroid therapy was approximately 4 times more effective (4.25, $P = .01$, CI: 1.27-14.15) compared to those who received only intratympanic steroid therapy in this study. There was no significant difference in terms of the effect of improving the level of hearing among those who received only intratympanic steroid therapy ($P = .55$, OR 1.46, CI: 0.41-5.15) and only systemic steroid therapy ($P = .058$, OR 0.34, CI: 0.11-1.03). When evaluated according to the modified Siegel's criteria, the total recovery rate was 66% (n = 55) among those receiving steroid treatment, whereas 34% (n = 34, including those not receiving steroid treatment) did not recover. Of the total treated population, 53% (n = 44) achieved full recovery, whereas 13% (n = 11) achieved partial recovery.

Osafo et al[7] found that the complete recovery rate according to Siegel's criteria was 14.86% in patients treated with intratympanic steroid therapy for ISSNHL. In comparison, the rate of patients who did not achieve improvement based on all other guideline criteria was 62.16%.[7] In their retrospective study, Attanasio et al[3] reported a success rate of 47.2% in hearing improvement, in which they administered intratympanic steroid therapy as an initial treatment in patients diagnosed with SHL. Additionally, they stated that every delayed day from the onset of the disease until the diagnosis and therapy were initiated reduced treatment success by 3%. Sugihara et al[2] reported that the frequency of intratympanic steroid injections in patients with SHL and the administration of systemic steroids before, after, and simultaneously with intratympanic treatment did not significantly improve hearing, and they had similar improvement results. They also reported that hearing evaluations did not positively contribute to the follow-up results after 6 months. We also followed up the patients for 6 months. We did not observe a significant difference in hearing improvement between patients receiving combination therapy and those receiving intratympanic or systemic steroid therapy. Wu et al[12] reported that adding intratympanic steroid therapy to the initial salvage therapy improved hearing recovery rates in cases where the initial salvage therapy effectiveness was low. Mirian et al[13] conducted a meta-analysis on the efficacy of steroids in the treatment of ISSNHL. They reported that systemic steroid therapy resulted in better hearing gain than intratympanic therapy at the beginning of the treatment.

Table 5. Recovery Rates According to Modified Siegel's Criteria in the Treatment Group

Modified Siegel's Criteria n = 83 (%)		Complete Recovery	Partial Recovery	No Recovery	Total	
					Hearing Improvement	No Recovery
Grade 1	Intratympanic	1			9 (90)	1 (10)
	Systemic	8				
	Combination			1		
Grade 2	Intratympanic	2		2	18 (69)	8 (31)
	Systemic	13		4		
	Combination	3		2		
Grade 3	Intratympanic	2	3	7	28 (60)	19 (40)
	Systemic	11	2	5		
	Combination	4	6	7		
		44 (53)	11 (13)	28 (34)	55 (66)	28 (34)

However, no statistically significant difference was observed between the 2 methods in terms of complete recovery. They also stated that no treatment method was superior to the others. In this study, statistically significant improvements in hearing were achieved separately in all 3 groups from a statistical perspective. In addition, we found that the systemic steroid group was statistically more influential than the other 2 groups in terms of the hearing improvement rate. A comprehensive systematic review and meta-analysis reported that combination steroid therapy was more effective and statistically significant than systemic steroid therapy in ISSNHL. However, intratympanic treatment did not create a statistically significant difference in improving hearing compared to either therapy.[14] The mechanism of action of steroids, known to be the best treatment option for ISSNHL, is yet to be fully understood. Intratympanic steroid applications can be initiated concurrently with, before, or after systemic steroid treatment. Both systemic and intratympanic administration can have undesirable side effects. Depending on the injection and systemic steroid application, both can cause otalgia, dizziness, tympanic membrane perforation, sleep disorders, mood changes, and changes in glucose metabolism. In SHL patients with diabetes mellitus, hypertension, cataracts, or osteoporosis, intratympanic applications with fewer systemic side effects during treatment are preferred.[15,16] Ng et al[17] have shown that intratympanic steroid application as a salvage treatment statistically improves hearing rates in patients who did not benefit from systemic steroid therapy, the first-line therapy for SHL. Covelli et al[18] reported that intratympanic steroid treatment as salvage therapy did not significantly help patients with severe hearing loss in the treatment of ISSNHL. However, they recommended intratympanic steroid administration as a salvage treatment in cases of complete deafness in which systemic steroids fail. Murray et al[19] reported in their meta-analysis and systematic review that the true efficacy of steroids for treating ISSNHL currently needs to be determined because of the different methodologies used in each study, the duration of steroid use, and the criteria used to evaluate improvement in hearing. They also reported that long-term steroid use did not treat this disease. Many researchers recommend multicenter, truly randomized, double-blind studies to identify a standardized, evidence-based therapy for ISSNHL.[19]

Currently, the most effective treatment for SHL is steroids. To avoid systemic side effects, the use of an intratympanic modality, which is effective in medicine, is recommended. Our study observed that steroid treatment was effective in patients with ISSNHL and that systemic steroid treatment was more effective than intratympanic treatment. We also observed that intratympanic treatment improved hearing rates, both at the beginning and after systemic therapy. The effectiveness of steroid treatment should be demonstrated in multicenter, randomized studies on ISSNHL diagnosis.

Ethics Committee Approval: The study protocol was approved by the Ethics Committee of Niğde Ömer Halisdemir University Faculty of Medicine (Approval No: 2020/64 Date: 12.11.2020).

Informed Consent: Written informed consent was obtained from the patients who agreed to take part in the study.

Peer-review: Externally peer-reviewed.

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