Can Intratympanic Steroid Be Initial Therapy for Sudden Sensorineural Hearing Loss?

Original Investigation

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Abstract

Objective: To evaluate the efficacy of intratympanic steroid treatment with concurrent systemic steroids as an initial therapy for sudden sensorineural hearing loss (SSNHL).

Methods: Patients who were diagnosed as idiopathic SSNHL and received no therapy were included in the study. Patients were divided into control and study groups. Patients in the study group received concurrent intratympanic steroid treatment with systemic steroid therapy. Patients in the control group received standard systemic steroid treatment alone. The duration of time before the treatment was evaluated for all the patients. Pure tone audiometry (PTA) was performed for all the patients in the pre-treatment and post-treatment period in order to record the responses for both in terms of the individual frequencies and the pure tone average.

Results: Twenty nine patients (16 female and 13 male) with a mean age of 43.6 years were enrolled in the study. There was 15 patients in the study group and 14 patients in the control group. The mean duration of time for the initial therapy was 4 days for the control group and 6.5 days for the study group (p=0.125). The mean recovery in PTA for the control group was 10.29±4.10 decibel (dB) (0-15) while it was 19.40±18.84 dB (3-68) for the study group (p=0.003).

Conclusion: At the end of treatment, significantly better hearing results were obtained for the patients in the study group when compared to the control group both for PTA and all the frequencies individually. We suggest that concurrent intratympanic steroids with systemic steroid therapy gives better hearing results than the standard systemic therapy alone.

Key Words: Sudden sensorineural hearing loss, initial treatment, intratympanic treatment, steroid

Introduction

Treatment of sudden sensorineural hearing loss (SSNHL) is still being discussed in the community of otology. For this disease, which has been known for more than 60 years, the only treatment method that has been accepted all around the world and the efficacy of which has been proven with randomized clinical studies is steroid therapy (1). However, there are some studies defending that steroid treatment can not be the gold standard (2).

Many treatment methods have been tried as an alternative to steroid treatment, but it has been found that no method is as efficient as steroids in the treatment of this disease (3, 4). Since it is thought that viral factors play a role in the etiology of the disease, antiviral agents are suggested to be used for treatment. However, Tucci et al. (5) compared valacyclovir and prednisolone therapies in their study and could not suggest that antiviral treatment was superior to steroid treatment. Similarly, in the study conducted by Westerlaken et al. (6), they compared acyclovir and prednisolone and found no superiority of these treatments over steroid treatment.

Vasoactive and hemodilutional agents, such as pentoxifylline, nifedipine, and gingko biloba, and alternative methods, including magnesium treatment, fibrinogen, contrast media, and hyperbaric oxygen therapy, are still being tried, but none of them has been found to be superior to steroid treatment (7, 8).

Erichsen et al. (9) demonstrated corticosteroid receptors in the inner ear. Corticosteroids affect the target tissue by decreasing capillary permeability, stabilizing lysosomal membranes, and suppressing immune-mediated inflammatory responses. It is thought that corticosteroids, with all these effects, resolve inflammation of the cochlea and acoustic nerve (10, 11).

The dose and administration way of steroid treatment are variable. Although some health centers recommend a megadose as the initial dose (500 or 1000 mg), the administration way approved in the literature is systemic steroid treatment with an initial dose of 1 mg/kg (12). This dose can be adjusted depending on the presence of concurrent diseases, like diabetes mellitus.

A method that has been used recently is direct transtympanic injection of steroid into the middle ear cavity. The efficacy of this treatment, which is called intratympanic steroid treatment (ITS) in the literature, has been reported in many studies

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(13, 14). However, the timing of this therapy is controversial. ITS is usually used as a rescue therapy for patients who do not benefit from systemic steroid treatment (15).

Intratympanic administration of medication for ear diseases was first used by Schuknecht for the treatment of Meniere's disease (16). In intratympanic administrations, the drug injected into the middle ear is absorbed through the round window by diffusion and then passes into the inner ear; thus, the required dose of inner ear fluids can be obtained soon and easily. This treatment method has also been administered for SSNHL patients for about 15 years. In the studies performed, it was reported that the drug administered by transtympanic route could reach the required concentration in the inner ear easily, whereas a very high dose of steroid was needed to reach an adequate concentration in the inner ear fluids in systemic steroid treatment (17).

Methods

This study was approved by the Ethics Committee of the Faculty of Medicine at Ankara University (11.01.2011/16-626-11). Patients who were diagnosed with idiopathic SSNHL in the last 10 days and who had received no therapy in the otorhinolaryngology clinic between the years of 2011-2013 were included in the study. The diagnostic criterion was considered as having sensorineural hearing loss at successive 3 frequencies at 30 decibel (dB) and above in 3 days. All patients were exposed to cranial magnetic resonance imaging, hemogram, and peripheral smear. Their viral and autoimmune markers were evaluated, and immunological examinations were performed. Patients with any abnormalities detected during these evaluations were excluded from the study. Only patients with a diagnosis of idiopathic SSNHL were included in the study. The patients were divided into control and study groups.

The control group involved patients who received standard SSNHL treatment that was administered in our clinic (oral 1 mg/kg/day dexamethasone, given every other day with decreasing doses). The study group included the patients exposed to concurrent intratympanic dexamethasone injection with standard systemic steroid therapy. During the ITS treatment, the patients were placed in the supine position, keeping their heads steady at an angle of 45 degrees. Then, transtympanic injection of 0.5 ml dexamethasone with a concentration of 10 mg/cc was administered into the middle ear cavity using a 9-cm 25-gauge spinal needle. After that, the patients were instructed to remain in this position for 15 minutes and to avoid swallowing in order to prevent the injected fluid from leaking into the nasopharynx. This process was applied to each patient every other day for a total of three times. Before ITS treatment, all patients were informed about this process and its risks in detail, and their written informed consents were obtained. At the end of the study, the audiogram results conducted on the 30th day following treatment were compared for the study and control groups. Hearing thresholds at 500, 1000, 2000, and 3000 Hertz (Hz) on pure-tone audiometry were evaluated, and the mean pure-tone was identified for each patient. The results were compared statistically.

Statistical Analysis

The data obtained were analyzed using Statistical Package for the Social Sciences (SPSS) for Windows 15. Pearson's chi-square and Fisher's exact tests were used for evaluating nominal variables. The value of $p<0.05$ was accepted as statistically significant.

Results

Of 29 patients who participated in the study, 13 were male and 16 were female, and the mean age was 43.6 years. The mean time for admission to the hospital was 4.9 days. The mean duration of time for the initial therapy was 6.5 days for the study group and 4 days for the control group, and there was no statistically significant difference between the two groups in terms of duration of time ($p=0.125$). Hearing loss was unilateral in all patients. The left ears of 12 patients and the right ears of 17 patients were affected. Based on the medical records, all patients were assumed to hear normally at a level of 20 dB before SSNHL, because none of them had an audiogram that had been performed previously. Also, no significant difference was found between the two groups in terms of hearing loss levels, estimated according to these data. In the study group, the mean age of 15 patients was 40.6 years (21-58 years). Of these patients, 7 were female and 8 were male. The control group included 14 patients; 6 were male and 8 were female. Also, the mean age was 46.8 years (25-66 years). There was no statistically significant difference between the groups in terms of gender, age, the ear that was affected, and the time for admission to the hospital. For the control group, recovery in the mean pure tone was 10.29±4.108 dB (0-15) on average on the 30th day following treatment, while it was 19.40±18.841 dB (3-68) for the study group (Table 1). For the control group, improved values of hearing thresholds at 500, 1000, 2000, and 3000 Hz were calculated as 11.36, 9.57, 8.86, and 10.29 dB, respectively. The same values for the study group were 18.40, 20.07, 20.73, and 19.40 dB, respectively (Figure 1). When both groups were compared in terms of individual frequencies, significantly better improvement was determined in the study group for all frequencies individually (Table 2).

In conclusion, for the control group, which was given only systemic steroid, the recovery in mean pure tone was found to be 10.29 dB, while it was 19.40 dB for the study group. The recovery rate in the study group was significantly higher than in the control group ($p=0.003$). No serious complication developed in any patient after treatment.

Discussion

SSNHL, which was first defined by DeKleyn in 1944, has been discussed in the community of otology in terms of either etiological factors or treatment alternatives for years. In the treatment of SSNHL, a relatively frequent disease, the gold standard

Table 1. Comparison of post-treatment pure-tone means for the two groups

	n	Mean recovery	Standard deviation	Minimum	Maximum
Study group	15	19.40	18.841	3	68
Control group	14	10.29	4.108	0	15
Total	29	15.00	16.685	0	68

is steroid therapy (1-3). In addition, many methods, including rheological agents, contrast media, vasodilators, antiviral agents, and hyperbaric oxygen therapy, are still tried (4-8). Some of these have lost their importance, and some methods, such as hyperbaric oxygen therapy, are being investigated (18).

As an alternative to systemic steroid treatment, in 1996, Silverstein directly administered the drug into the middle ear by means of intratympanic injection (19). Then, many researchers studied ITS treatment for SSNHL and reported positive results (20, 21). Intratympanic perfusion treatment has two advantages. Firstly, because the drug passes into the inner ear through diffusion from the round window membrane, there is no risk for any systemic side effect. Thus, corticosteroids can be used intratympanically when systemic treatment is contraindicated. The second advantage of intratympanic treatment is that the drugs injected can reach very high concentrations in the perilymph in a short time. In experimental studies, it was revealed that higher perilymphatic concentrations were reached with intratympanic corticosteroid administrations compared to systemic treatment. Also, it was found that the highest corticosteroid concentrations with the longest duration were obtained with hydrocortisone, dexamethasone, and methylprednisolone (22). It was observed that histamine, which was administered with dexamethasone into the round window membrane, facilitated passing into the perilymph, and dimethylsulfoxide and hyaluronic acid, which were used for the same purpose, contributing to increasing diffusion (23).

By means of administering methylprednisolone through an osmotic mini-pump and intratympanic dexamethasone, the hearing levels of many patients improved significantly. In light of increasing studies, it was stated that ITS treatment provided significantly positive results for autoimmune inner ear disease as well as SSNHL (24, 25).

Dexamethasone and methylprednisolone are used in intratympanic corticosteroid administrations. The dose of dexamethasone differs preferably, but it is usually 4-24 mg/cc. Due to the increased risk for permanent perforation at high corticosteroid concentrations, the most preferred dose for dexamethasone is 10 mg/cc. Methylprednisolone is used at a dose of 40 mg/cc. Intratympanic corticosteroid administration techniques include direct administration into the middle ear through a single or two micro-perforations; administration through a ventilation tube; administration on a bougie that was placed in a ventilation tube and towards the round window niche; and administration

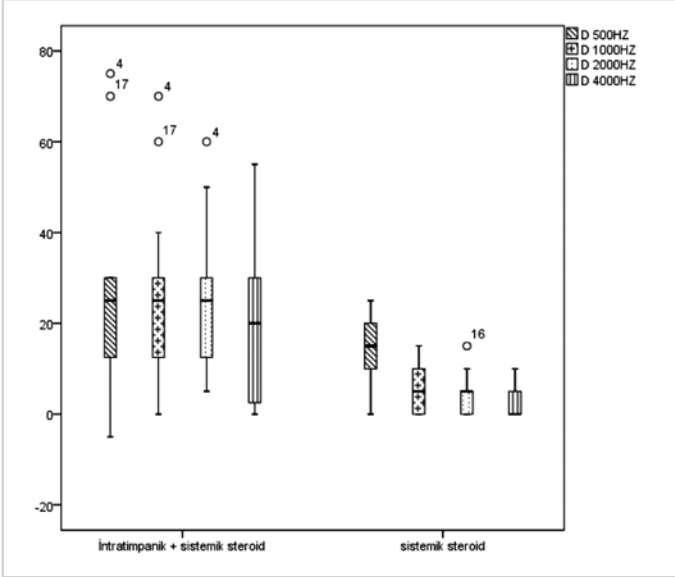

Figure 1. Comparison of recovery in pure-tone means in terms of frequency for both groups

Table 2. Statistical comparison of recovery in pure-tone means in terms of frequency for both groups

	Frequency			
	500 Hz	1000 Hz	2000 Hz	4000 Hz
p	.026	.001	.000	.003

with an osmotic mini-pump and round window micro-catheter (13).

In the study conducted by Parnes in 1999, it was reported that steroid given by intratympanic injection reached higher concentrations in the inner ear compared to oral or intravenous injection (26). According to this result, higher drug concentrations are obtained in the perilymph through intratympanic treatment, but systemic side effects decrease because of the low plasma concentration. Considering that the major problem of systemic steroid treatment is its side effects, the importance of intratympanic treatment is understood.

In the literature review, it is seen that there are some recent studies defending that combined intratympanic and systemic steroid treatments can be used as a safe and efficient initial therapy for SSNHL patients (27, 28). Gündoğan et al. (29) emphasized that combined intratympanic and oral treatment was superior to only steroid therapy. Moreover, Battaglia et al. (30) reported

that combined treatment was superior to only high-dose systemic steroid treatment. The results of these studies are consistent with those of our study, and they provide strong evidence that intratympanic treatment can be used as the initial protocol for SSNHL in the long term.

In our study, we aimed to demonstrate that therapeutic efficacy can be increased by combining intratympanic steroid treatment, which is usually used as rescue treatment, with systemic steroid treatment. The results were found to be better for the study group than for the control group. In light of these results, we suggest that concurrent intratympanic steroid treatment with systemic steroid therapy can be administered as the initial therapy, and thus, therapeutic efficacy can be improved in SSNHL patients. In the study, no complication was observed in patients who received ITS treatment. Based on this result, ITS injection is considered a safe treatment method. The low number of patients in both groups is the limitation of our study. Further studies with larger sampling groups will shed light on this treatment method.

Conclusion

We suggest that concurrent intratympanic steroid treatment with conventional systemic steroid treatment will positively contribute to the hearing results of patients with sudden sensorineural hearing loss.

Ethics Committe Approval: Ethics committee approval was received for this study from the ethics committee of Clinical Investigation of Ankara University Faculty of Medicine (11.01.2011/16-626-11).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

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