CLINICAL STUDY

# EVALUATION OF TREATMENT RESULTS APPLIED IN SUDDEN HEARING LOSSES TREATED IN OUR CLINIC

Burak ERDEN [1], MD; Gökçe ŞİMŞEK [2], MD; Rahmi KILIÇ [3], MD;

*[1]Mersin Şehir Eğitim ve Araştırma Hastanesi, Kulak Burun Boğaz Anabilimdalı, Mersin, Turkey [2]Kırıkkale Üniversitesi Tıp Fakültesi, Kulak Burun Boğaz Anabilimdalı, Kırıkkale, Turkey [3]Ankara Eğitim ve Araştırma Hastanesi, Kulak Burun Boğaz Anabilimdalı, Ankara, Turkey*

**SUMMARY**

Purpose: Sudden sensorineural hearing loss (SSNHL) is sensorineural hearing loss over 30 dB, which develops abruptly in less than three days, affecting three or more frequencies. Prognostic factors affecting the treatment results and treatment outcomes of patients with SSNHL were examined in this study.

Material and method: Between 2011 and 2014, 65 cases included in 68 ear studies. All patients were given steroids, vasodilator drugs (betahistine) and vitamin B. In the treatment of patients who did not show significant audiological improvement in 5 days, in the event that they gave consent, 0.5-0.7 cc 250 mg methylprednisolone of intratympanic was added per day in addition to systemic steroid therapy and salvage treatment was performed. Anamnesis details and clinical findings of patients, audiological configurations and degrees of hearing loss, treatment start times, vertigo and tinnitus relationship with the SSNHL and the effects of these factors on prognosis were examined in this study.

Results: In this study, 31 of the cases were male and 34 were female. The age range was between 12-75 (average 44.2). It was observed that twelve (17.6%) cases had mild, 23 (33.8%) had moderate, 24 (35.3%) had advanced and 9 (13.2%) had very advanced SSNHL. In patients treated early, statistically significant results were obtained in terms of positive response to treatment ($p<0.05$). Statistically significant results were obtained in terms of hearing loss degree and good response to treatment in patients with SSNHL ($p<0.05$). There was no significant differences between tinnitus and vertigo and SSNHL relationship ($p>0.05$).

Conclusion: Early treatment and low degrees of SSNHL severity are positive prognostic factors.

*Keywords: Hearing Loss, Sudden; Etiology; Prognostic Factors; Treatment Effectiveness*

**KLİNİĞİMİZDE TEDAVİ GÖREN ANİ İŞİTME KAYIPLARINDA UYGULANAN TEDAVİ SONUÇLARININ DEĞERLENDİRİLMESİ**

**ÖZET**

Amaç: Ani sensörinöral işitme kaybı (SSNHL), üç günden daha kısa sürede aniden gelişen ve üç veya daha fazla frekansı etkileyen 30 dB üzerindeki sensörinöral işitme kaybıdır. Bu çalışmada SSNHL'li hastaların tedavi sonuçları ve tedavi sonuçlarını etkileyen prognostik faktörler incelenmiştir.

Gereç ve yöntem: 2011-2014 yılları arasında 65 hasta ve 68 kulak çalışmaya dahil edildi. Tüm hastalara steroid, vazodilatör ilaçlar (betahistin) ve B vitamini verildi. 5 gün içerisinde odyolojik olarak belirgin iyileşme göstermeyen hastaların tedavisine onam vermeleri halinde sistemik steroid tedavisinin yanına gün aşırı intratimpanik 0.5-0.7cc 250 mg metilprednizolon eklenerek salvage tedavisi uygulandı. Klinik bulguları, odyolojik konfigürasyonları ve işitme kayıplarının dereceleri , tedavi başlama süreleri, vertigo ve tinnitusla SSNHL ilişkisi ve bu faktörlerin prognoz üzerine olan etkileri bu çalışmada incelendi.

Bulgular: Bu çalışmada olguların 31'si erkek 34'i bayan idi. Yaş aralığı 12-75 arasında idi (ortalama 44.2). On iki (%17.6) olguda hafif, 23 (%33.8) olguda orta, 24 (%35.3) olguda ileri ve 9 (%13.2) olguda çok ileri SSNHL olduğu görüldü. Erken tedavi verilmiş olgularda, tedaviye olumlu yanıt açısından istatistiksel olarak anlamlı sonuçlar alındı ($p<0.05$). SSNHL'li olgularda işitme kaybı derecesi ve tedaviye iyi yanıt açısından istatistiksel olarak anlamı sonuç alındı ($p<0.05$). Tinnitus ve vertigoyla SSNHL ilişkisi arasında anlamlı bir fark görülmedi ($p>0.05$).

Sonuç: Tedaviye erken başlanması ve SSNHL şiddetinin düşük derecelerde olması olumlu prognostik faktörlerdir.

*Anahtar Sözcükler: Ani işitme kaybı; Etiyoloji; Prognostik faktör; Tedavi etkinliği*

Corresponding Author: Burak ERDEN MD. Mersin Şehir Eğitim ve Araştırma Hastanesi, Kulak Burun Boğaz Anabilimdalı, Mersin, Turkey, E-mail: burakerden@windowslive.com

Received: 20 July 2020, revised for: 19 October 2020, accepted for publication: 21 October 2020

Cite this article: ERDEN B., ŞİMŞEK G., KILIÇ R., Evaluation Of Treatment Results Applied In Sudden Hearing Losses Treated In Our Clinic. KBB-Forum 2020;19(4):403-413

## INTRODUCTION

Sudden sensorineural hearing loss (SSNHL) is evaluated as sensorineural hearing loss (SNHL) over 30 dB, which develops abruptly in less than three days, affecting three or more frequencies [1]. The most important characteristics are that it has a sudden onset, hearing loss is not fluctuating, possibly one ear is involved and in some cases probability of spontaneous recovery is high [1-3] In the histopathological examinations it has been

reported that viral infections, vascular events, immunological reactions and membrane rupture of the labyrinth are the most focused on causes that of SSNHL [4].

In order to create the necessary treatment scheme based on the patient, known etiological reasons that cause the SSNHL should be put forward. However, etiological causes cannot be detected in the majority of patients. Patients for whom a cause cannot be found are considered idiopathic and one of the treatment algorithms for possible causes is preferred [5,6].

The only treatment shown to be effective in the SSNHL is the steroid treatment that is given as soon as possible after the appearance and diagnosis of symptoms. The finding of the high effectiveness of steroids compared to placebo in Wilson's randomized placebo-controlled steroid study in 1980 is considered a pioneer for this treatment [7]. The purpose of steroid treatment in the SSNHL is the suppression of inflammation caused by viral infection, microcirculation disorders and cochlea after autoimmune events [8,9].

A combination or stand-alone steroid treatment can be started in the SSNHL. Multiple drugs should be given within the same period of time to treat many possible pathologies in patients with SSNHL as soon as possible, as the underlying causes or causes cannot be detected in most patients, there are many diseases that may be a cause and treatment should be started as soon as possible. Acyclovir, dextran, ginkgo biloba, nifedipine, magnesium, vitamins (B, E, C), pentoxifline, carbogen, hyperbaric oxygen, stellate ganglion blockage, heparin, histamine, along with agents such as heparin, can be combined and used [6].

Prognostic factors affecting the treatment results and treatment outcomes of patients with SSNHL were examined in this study. However, the efficacy of systemic steroid and salvage intratympanic treatments was investigated.

## MATERIAL and METHODS

The study was started after the approval of the ethics committee of Kırıkkale University Medical Faculty on 06/07/2015 and 19/22 decision number. In the study, the files of the patients who were treated inpatiently between 2010 and 2014 at Kırıkkale University Faculty of Medicine in the Department of Otorhinolaryngology whose international classification of diseases [ICD)] code was entered as " H 91.2 Sudden idiopathic hearing loss" were accessed. The epicrisis records of these files were examined and patients whose diagnoses were determined as meniere disease in later periods were not included in the study. After reducing to 87 patients [45 female (F), 42 male (M)] who were admitted and treated impatiently with a diagnosis of SSNHL, 19 (9 F, 10 M) patients who had incomplete audiological evaluations were excluded from the study. The other 3 patients (2 F, 1 F) were excluded from the study because they were diagnosed with high fistula. Each ear of bilateral SSNHL cases was evaluated separately and included in the study in the form of 6 separate ears. As a result, 62 unilateral and 3 bilateral SSNHL (68 ears) patients were included in the study.

Detailed anamnesis were taken from the patients who participated in the study. Gender, patient age, hearing loss onset and how it started, time of applying to hospital, whether it was accompanied by vertigo or tinnitus, the condition of other comorbid diseases were questioned in detail.

Detailed otorhinolaryngology examinations of the patients were performed. The patients were examined audiologically. Pure tone audiometry (Interacoustics AC 40 Denmark), tympanogram device (Interacoustics AT22T Denmark) and tympanogram and acoustic reflex measurements were observed.

The pure tone average (PTA) at frequencies of 250, 500, 1000, 2000 and 4000 Hz was performed to include the threshold for receiving the conversation, the score of distinguishing the conversation, tympanogram, acoustic reflex measurements for all patients. In our clinic, we do not prefer the primary intratympanic treatment option in patients with sudden hearing loss if there is no contraindication for oral steroids. However, we prefer the principle of giving the maximum treatment we can give under close audiological follow-up. Therefore, we make an interim

evaluation within 5 days after starting the treatment and start intratympanic treatment in patients who do not see significant improvement. Therefore, PTA is checked in all patients before starting treatment and on the 5th day after it starts. If only medical treatment was received audiological evaluation was performed at the end of treatment and in the second month. According to the results of the 5th day audiological evaluation, audiological evaluation was also performed for patients who were scheduled for intratympanic salvage treatment at the end of treatment and in the second month.

In laboratory examination, full blood count, routine biochemistry (Glucose, total lipid, cholesterol, triglyceride and electrolyte), thyroid function tests (T3,T4,TSH), coagulation tests (PT, aPTT), sedimentation value were looked at. All patients who accepted hospitalization during the duration of treatment were hospitalized. Temporal CT was performed in all patients to rule out intracranial hemorrhages and acute stroke and temporal MRI with gadolinium performed in all patients to exclude retrocochlear pathologies.

As a treatment protocol, oral steroids, vasodilator drugs (betahistine) and vitamin B treatments were started for all patients. Valacyclovir was added to the treatment of patients who applied within seven days. Oral methylprednisolone (Prednol 4-16 mg tb, Gensenta, Istanbul, Turkey) was the choice of steroid. It was started at a dose of 150 mg for the first 3 days. On the 4th and 5th days, the dose of 1mg / kg / day was continued according to the patient's weight. On the 6th day and after, the treatment was terminated by deducting 10mg every other day from the current dose.

Systemic treatments for patients who have shown complete or significant audiological improvement have been completed. If the patients who did not show significant improvement in audiological terms within 5 days gave their consent, besides the systemic steroid treatment, intratympanic 0.5-0.7 cc volume 250 mg MP (Prednol-L 250mg, Gensenta, Istanbul, Turkey) was added to their treatment every other day and salvage IT treatment was applied. In our clinic, 7 injections are made every other day and intratympanic treatment is terminated.

There are many different approaches in the literature regarding treatment evaluation times. Current sources state that treatment should be started within the first 14 days [1,10]. Considering J.B. Booth's classification and current sources according to the time of starting treatment for patients following application to the hospital, applicants were divided into classes as those who applied in 1 week, 1-2 weeks and 3 weeks or more and the responses given to treatment were compared.

Patients were classified according to the degree of hearing loss as mild (20-39dB), moderate (40-59dB), moderately severe (60-84dB), severe (85dB and above). Patients were evaluated in four groups according to audiogram configurations as ascending (losses affecting 250-500 Hz), descending (losses affecting 4000-8000 Hz), flat type (losses with the worst and best audiogram thresholds less than 20dB), in total and near total [10].

According to the audiogram configurations, patients were considered to be at full recovery if the PTA reached normal level (20 dB and below), at significant recovery if PTA improved more than 30 dB, but if it did not reach normal limits and at moderate recovery if the PTA had improved between 10-30 dB. Recoveries below 10 dB were not considered as improvement because they were not seen as meaningful. In the audiogram, if the PTA was at the same or normal hearing level as the robust ear (20 dB and lower) or it had reached the same hearing level in the patient's audiogram before the disease is was included in the full recovery class. A gain between 11-29 dB in the PTA was considered a slight recovery, recoveries between 0-10 dB were considered as no recovery. These criteria set by the "Ad Hoc Commitea of Japanese Ministry of Health and Welfare" were preferred in our study [11].

**Statistical analysis**

The data obtained in this study were analyzed with software SPSS version 20.0. Shapiro Wilk was used due to the number of units when investigating the normal distribution of variables. When interpreting the results, 0.05

was used as the level of significance; It was stated that if p <0.05, the variables did not come from the normal distribution, if p> 0.05, the variables were from the normal distribution. When examining the differences between the groups, an Independent t-Test was used if the normal distribution is observed. Kruskal Wallis-H Test was used if normal distribution was not observed. Post-Hoc Multiple Comparison Test was performed in case of significant differences were observed with Kruskal Wallis-H Test. While examining the relationships between the groups of nominal variables, Chi-Square analysis was applied. In cases where at least one of the expected values in the cells es are lower than 5 in 2x2 tables, Fisher's Exact Test was used and Pearson Chi-Square analysis was applied in RxC tables with the help of Monte Carlo Simulation. When interpreting the results, 0.05 was used as the level of significance; When examining the difference between the two dependent variables, the Wilcoxon rank sum Test was used if the variables are not normally distributed.

## RESULTS

62 unilateral and 3 bilateral SSNHL (68 ears) patients were included in the study. Of the cases, 31 were male, 34 were female, and the age ranged from 12 to 75 (the mean age was 44.2±14.4). No significant difference was found between the sexes in terms of the age of the patients (Table 1). Patients were grouped according to PTA as mild between 20-39 dB, moderate between 40-59 dB, moderately severe between 60- 84 dB and severe at 85 dB and above. 12 (17.6%) cases were considered mild, 23 (33.8%) cases were moderate, 24 (35.3%) cases were moderately severe and 9 (13.2%) were considered severe . Patients were grouped as 1 week, 2 weeks and 3 weeks or more according to the application period. It was seen that 44 (64.7%) of the patient's had applied in the 1st week, 11 (16.2%) of the patient's in the 2nd week, 13 (19.1%) in the third week respectively.

Patients were evaluated according to their degree of recovery. 30 (44.2%) patients had a full recovery, 11 (16.1%) patients had a significant recovery, 16 (23.5%) patients had moderate recovery and 11 (11.1%) patients did not experience recovery. A statistically significant relationship was found between the rate of hearing loss and recovery according to the 2nd month PTA values (Table 2). 16 (23.5%) patients had ascending, 9 (13.2%) had descending, 9 (13.2%) had total and 34 (50%) had flat type of audiological configuration and no statistically significant relationship was found between 2nd month control recovery rates and audiological configuration (Table 3).

After treatment, the relationship between the improvement in the PTA and tinnitus was investigated. While tinnitus was observed in 53 (77.9%) patients it was not observed in 15 (22.1%) patients. There was no statistically significant relationship between recovery according to PTA on the 5th day after systemic treatment, recovery according to PTA after salvage treatment and recovery according to 2nd month control PTA and tinnitus. After treatment, the relationship between vertigo and recovery in the PTA was investigated. While vertigo was observed in 18 (26.5%) patients, it was not observed in 50 (73.5%) patients. There was no statistically significant relationship between recovery according to the PTA on the 5th day after systemic treatment, improvement according to the PTA after salvage treatment, and recovery results according to the control PTA results at the 2nd month and vertigo (Table 4).

When the relationship between the duration of application to the hospital and recovery is examined, while 59.1% of those admitted to the hospital in the 1st week and 36.4% of those admitted to the hospital in the 2nd week recovered fully; 9.1% of those admitted to the hospital in week 1, 27.3% of those admitted in week 2 and 30.8% of those admitted to the hospital in week 3 or above did not recover. There is a statistically significant relationship between improvement according to the 2nd month control PTA (Table 5).

There is a statistically significant difference between PTA values before systemic treatment and the 5th day PTA after systemic treatment (Table 6). PTA values before systemic treatment are significantly higher than PTA values for 5th day after systemic treatment. There is a statistically significant difference between PTA values on the 5th day after

systemic treatment and PTA values after salvage treatment (Table 6). After the 5th day of systemic treatment, salvage treatment was performed in 28 of the 68 patients, and 5th day PTA values after systemic treatment are significantly higher than PTA values after salvage treatment. There is a statistically significant difference between the PTA values after salvage treatment and 2nd month control PTA values (Table 6). PTA values after salvage treatment are significantly higher than 3nd month control PTA values.

In patients with SSNHL, it is seen that systemic treatment has a positive effect on short and long-term prognosis. In SSNHL cases, it is seen that the addition of the application of IT corticosteroids in the early period to systemic treatment creates a positive change on prognosis. In addition, a significant increase was observed between 2nd month control PTA results and after salvage treatment PTA results.

**Table 1.** Relationship Between Age and Gender

| | | Patient's Gender | | | | | | Independent t test | |
|---|---|---|---|---|---|---|---|---|---|
| | | **n** | **Mean** | **Median** | **Min** | **Max** | **ss** | **t** | **p** |
| **Patient's Age** | **Male** | 31 | 41,5 | 41 | 12 | 71 | 15,7 | | |
| | **Female** | 34 | 46,8 | 47,5 | 19 | 75 | 12,7 | -1,51 | 0,136 |
| | **Total** | 65 | 44,2 | 45 | 12 | 75 | 14,4 | | |

**Table 2.** Relationship Between Recovery and Hearing Loss Rating according to 2nd Month Control PTA

| | | 2nd Month Control Recovery | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Full Recovery** | | **Significant Recovery** | | **Moderate Recovery** | | **Lack of Recovery** | | **Total** | | **Chi Square Test** | |
| | | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **Chi Square** | **p** |
| **Degree of Hearing Loss** | **Mild (20-39dB)** | 7 | 23,3 | 0 | 0 | 3 | 18,8 | 2 | 18,2 | 12 | 17,6 | | |
| | **Moderate (40-59dB)** | 11 | 36,7 | 3 | 27,3 | 7 | 43,8 | 2 | 18,2 | 23 | 33,8 | | |
| | **Moderatelt Severe (60-84dB)** | 11 | 36,7 | 5 | 45,5 | 5 | 31,3 | 3 | 27,3 | 24 | 35,3 | * | **0,042** |
| | **Severe (85dB and above)** | 1 | 3,3 | 3 | 27,3 | 1 | 6,3 | 4 | 36,4 | 9 | 13,2 | | |
| | **Total** | 30 | 100 | 11 | 100 | 16 | 100 | 11 | 100 | 68 | 100 | | |

* Since 20% of the expected value in the cells is less than 5%, Chi Square analysis was performed with the help of The Monte Carlo Simulation.

**Table 3.** 2nd Month Control Improvement According to Audiological Configurations

| | | 2nd Month Recovery Rates | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Full Recovery | | Significant Recovery | | Moderate Recovery | | Lack of Recovery | | Total | | Chi Square Test | |
| | | n | % | n | % | n | % | n | % | n | % | Chi Square | p |
| Audiometry Type | Ascending | 10 | 33,3 | 1 | 9,1 | 2 | 12,5 | 3 | 27,3 | 16 | 23,5 | | |
| | Descending | 3 | 10 | 2 | 18,2 | 4 | 25 | 0 | 0 | 9 | 13,2 | | |
| | Flat | 16 | 53,3 | 5 | 45,5 | 9 | 56,3 | 4 | 36,4 | 34 | 50 | * | 0,062 |
| | Total | 1 | 3,3 | 3 | 27,3 | 1 | 6,3 | 4 | 36,4 | 9 | 13,2 | | |
| | Total | 30 | 100 | 11 | 100 | 16 | 100 | 11 | 100 | 68 | 100 | | |

* Since 20% of the expected value in the cells is less than 5%, Chi Square analysis was performed with the help of The Monte Carlo Simulation.

**Table 4.** Relationship Between Recovery and Tinnitus and The Relationship Between Recovery and Vertigo

| | | Tinnitus | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Yes | | No | | Total | | Chi Square Test | |
| | | n | % | n | % | n | % | Chi Square | p |
| 5th Day Recovery Post-systemic Treatment | Full Recovery | 9 | 17 | 0 | 0 | 9 | 13,2 | | |
| | Singificant Recovery | 13 | 24,5 | 3 | 20 | 16 | 23,5 | | |
| | Moderate Recovery | 11 | 20,8 | 3 | 20 | 14 | 20,6 | * | 0,278 |
| | No Recovery | 20 | 37,7 | 9 | 60 | 29 | 42,6 | | |
| | Total | 53 | 100 | 15 | 100 | 68 | 100 | | |
| Post-salvage Recovery | Full Recovery | 5 | 25 | 4 | 50 | 9 | 32,1 | | |
| | Singificant Recovery | 6 | 30 | 1 | 12,5 | 7 | 25 | | |
| | Moderate Recovery | 6 | 30 | 3 | 37,5 | 9 | 32,1 | * | 0,42 |
| | No Recovery | 3 | 15 | 0 | 0 | 3 | 10,7 | | |
| | Total | 20 | 100 | 8 | 100 | 28 | 100 | | |
| 2nd Month Recovery | Full Recovery | 25 | 47,2 | 5 | 33,3 | 30 | 44,1 | | |
| | Singificant Recovery | 8 | 15,1 | 3 | 20 | 11 | 16,2 | | |
| | Moderate Recovery | 11 | 20,8 | 5 | 33,3 | 16 | 23,5 | * | 0,734 |
| | No Recovery | 9 | 17 | 2 | 13,3 | 11 | 16,2 | | |
| | Total | 53 | 100 | 15 | 100 | 68 | 100 | | |
| | | Vertigo | | | | | | | |
| | | Yes | | No | | Total | | Chi Square | |
| | | n | % | n | % | n | % | Chi Square | p |
| 5th Day Recovery Post-systemic Treatment | Full Recovery | 3 | 16,7 | 6 | 12 | 9 | 13,2 | | |
| | Singificant Recovery | 5 | 27,8 | 11 | 22 | 16 | 23,5 | | |
| | Moderate Recovery | 1 | 5,6 | 13 | 26 | 14 | 20,6 | * | 0,356 |
| | No Recovery | 9 | 50 | 20 | 40 | 29 | 42,6 | | |
| | Total | 18 | 100 | 50 | 100 | 68 | 100 | | |
| Post-salvage Recovery | Full Recovery | 3 | 33,3 | 6 | 31,6 | 9 | 32,1 | | |
| | Singificant Recovery | 2 | 22,2 | 5 | 26,3 | 7 | 25 | | |
| | Moderate Recovery | 4 | 44,4 | 5 | 26,3 | 9 | 32,1 | * | 0,661 |
| | No Recovery | 0 | 0 | 3 | 15,8 | 3 | 10,7 | | |
| | Total | 9 | 100 | 19 | 100 | 28 | 100 | | |
| 2nd Month Recovery | Full Recovery | 8 | 44,4 | 22 | 44 | 30 | 44,1 | | |
| | Singificant Recovery | 3 | 16,7 | 8 | 16 | 11 | 16,2 | | |
| | Moderate Recovery | 4 | 22,2 | 12 | 24 | 16 | 23,5 | * | 1,00 |
| | No Recovery | 3 | 16,7 | 8 | 16 | 11 | 16,2 | | |
| | Total | 18 | 100 | 50 | 100 | 68 | 100 | | |

* Since 20% of the expected value in the cells is less than 5%, Chi Square analysis was performed with the help of The Monte Carlo Simulation.

**Table 5**. Relationship Between Recovery and Application Time

| | | Hospital Application Time | | | | | | | | Chi Square Test | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 week | | 2 week | | 3 week and above | | Total | | | |
| | | n | % | n | % | n | % | n | % | Chi Square | p |
| 2nd Month Recovery | Full Recovery | 26 | 59,1 | 4 | 36,4 | 0 | 0 | 30 | 44,1 | * | **0,001** |
| | Singificant Recovery | 9 | 20,5 | 1 | 9,1 | 1 | 7,7 | 11 | 16,2 | | |
| | Moderate Recovery | 5 | 11,4 | 3 | 27,3 | 8 | 61,5 | 16 | 23,5 | | |
| | No Recovery | 4 | 9,1 | 3 | 27,3 | 4 | 30,8 | 11 | 16,2 | | |
| | Total | 44 | 100 | 11 | 100 | 13 | 100 | 68 | 100 | | |

* Since 20% of the expected value in the cells is less than 5%, Chi Square analysis was performed with the help of The Monte Carlo Simulation.

**Table 6.** Relationship Between Before Systemic Steroid and 5th day after Systemic Treatment, 5th day after Systemic Treatment and Salvage Treatment and After Salvage Treatment and 2nd Month Control Pesponses

| | | | | | | | Wilcoxon Test | |
|---|---|---|---|---|---|---|---|---|
| | n | Mean | Median | Min | Max | ss | z | p |
| PTA Values before systemic treatment | 68 | 60,7 | 59 | 28 | 118 | 21,6 | -6,785 | **0,001** |
| PTA values on the 5th day after systemic treatment | 68 | 44,1 | 36,5 | 8 | 118 | 25,9 | | |

| | | | | | | | Wilcoxon Test | |
|---|---|---|---|---|---|---|---|---|
| | n | Mean | Median | Min | Max | ss | z | p |
| PTA values on the 5th day after systemic treatment | 28 | 59,7 | 60,5 | 27 | 118 | 24,9 | -4,541 | **0,001** |
| PTA values after salvage treatment | 28 | 40,1 | 32,5 | 13 | 118 | 28,6 | | |

| | | | | | | | Wilcoxon Test | |
|---|---|---|---|---|---|---|---|---|
| | n | Mean | Median | Min | Max | ss | z | p |
| PTA values after salvage treatment | 28 | 40,1 | 32,5 | 13 | 118 | 28,6 | -2,693 | **0,007** |
| 2nd month control PTA values | 28 | 39 | 31,5 | 12 | 118 | 28,9 | | |

## DISCUSSION

According to the idea which is applied and accepted by a large segment today, oral steroids are the best treatment option. The steroid used was usually MP, while in some cases dexamethasone was used. In the studies, both MP and dexamethasone do not have a recommended application frequency and dose. MP is usually administered in the form of gradually decreased doses starting with 1mg/kg/day [7-9,12,13]. Recently, many researchers have reported different steroid protocols they apply in the SSNHL. Slattery and colleagues reported in 2006 that a 14-day treatment with 60 mg of oral prednisone per day was optimal [14]. We prefer MP as steroid type in our clinic. We give patients 150mg/day in the first 3 days and then we decrease a dose of 10 mg every other day from the dose of 1mg/kg/day.

Intratympanic treatment (IT) is applied in the form of "primary treatment" as the first

treatment without systemic steroids, "adjuvant treatment" as an addition to systemic steroids, in case of failure of systemic steroid therapy "salvage treatment" as a recovery treatment [15]. We prefer intratympanic treatment as a recovery treatment in our clinic.

Quite different methods are also used to distribute steroids to the middle ear by IT. Transtympanic needle injection is the most preferred method [1,15]. We also routinely use this method in our clinic. The other commonly used technique is injecting the steroid into the middle ear through a ventilation tube [1,15]. The advantage of this technique is that it can be applied by the patient at home, which provides ease of use. However, the amount of the drug given to the middle ear is unknown. In addition to having a risk of microorganisms in the outer ear path to pass into the middle ear, it is obvious that it will increase the risk of infection in the middle ear. Since it is also known that it is done with the correct method of application described to the patient, this method is not preferred in our clinic, where control is in the patient. Application varies in duration and frequency. IT treatment has been started as daily in some studies, weekly in some studies and every other day in others. While some authors prefer a single injection, others make up to 15 applications [6,9,12,13]. There are also patients who are infused continuously by installing microcatheters [16]. In our clinic, injection is performed 7 times every other day.

As with any application, IT steroid application contains some side effects and complications. The most common side effect is pain during injection. Phenol, tetrachein, lidocain were used to prevent pain. In our study, getocain anesthesia was applied and the anesthetic substance in the external ear path before IT treatment was carefully aspired to minimize possible side effects [6,8,9,13,15]. Another side effect is vertigo, which begins during injection. The mechanism of vertigo formation is the caloric effect forming in the lateral semicircular canal[8,9,15]. In order to reduce this, we administered an injection after heating the MP at body temperature for about 10 minutes, and there were no long-lasting vertigo complaints in almost any application except for the mild-intensity vertigo description of some patients lasting 5-10 minutes. One of the rare reported complications is the perforation of the eardrum[8,9,15]. This situation is resolved by local myringoplasty. We have not encountered temporary or permanent perforation. The most feared complication is that hearing gets worse than the current situation. Worsening hearing after IT injection is a very low risk, but there is not enough work in relation to its incidence. Even in the most failing patient series, the audiogram results remain the same [7-9,15].

Although in IT injection, it is thought that steroids will not constitute systemic complications, no clinical trial has been observed in which the amount added into the circulation through the eustachium. It is also known that the side effect of steroids has much less occurrence than systemic treatment in IT treatment.

The frequency of SSNHL has been reported in various proportions in the literature. The main reasons for this situation are that the frequency of spontaneous recovery is high and patients do not consult hospitals as being aware of this situation. Although the incidence varies, it has been reported as approximately 5-27/100,000 per year [17-19]. Although the incidence among all SNHLs is estimated to be around 1%, the actual frequency is not clear due to the high frequency of spontaneous recovery and patients not applying to hospitals as being aware of this situation [3,10,19,20]. Although there is no difference in gender distribution, it has been reported that the insidence is higher in 40-65 age groups compared to other age groups [2]. A correlation of racial or geographic variables have not been monitored for the disease [21]. In our study, the youngest of patients was 12 and the oldest was 75 years old and the average age was 44.2. Of

the patients, 31 were male and 34 were female. In our study, there is no statistically significant difference between the sexes in terms of the age of the patients ($p>0.05$).

SSNHL is an autological emergency, as it is known. When we look at the application period and the healing relationship; we found differences in the evaluation of the application time of patients in the studies done. We found that Shia and Sheehy treated the classification as 1 week, between 1-1 month and reporting improvement rates of 75% and 53% respectively[22]. In his book, J.B.Booth evaluated the work of different authorities and reported that treatment was effective when it started in the first 15 days, regardless of single and multiple drug protocols. In their clinical experience, they reported a recovery of 90% when they started treatment in the first week, 82% when they started within 1-2 weeks, and 20% full or partial recovery when they started between 2-4 weeks. In applicants between 1-3 months, there was no improvement [10]. In Byl's patient series a 56% improvement in 1 week applications was reported [18]. In our study, similar to the literature, the success achieved by treatment decreased as the application period was delayed and the application period was one of the positive prognostic factors.

When the treatment activities are considered, it is accepted that there are variations in some cases with SSHL. The degree of hearing loss at admission to the hospital, its relationship with vertigo, duration of treatment, and audiogram configuration are the most frequently considered variables by many physicians [3,18,22-24].

Byl and colleagues have reported improvement in 83% of patients with mild hearing loss and improvement in 22% of patients with severe hearing loss [18]. Li and colleagues reported the negative impact of the initial high level of SSNHL level on treatment [25]. In our study, similar to the literature, it was observed at the end of the 2nd month that the degree of hearing loss negatively affected the success of treatment and was a valuable prognostic factor.

The audiogram configuration is an issue in which different opinions are reported in the literature. Li and colleagues said that the response to treatment is better for those with a ascending type of audiogram [25]. In 54 disease studies by Gök and colleagues; they reported 18 ascending types, 17 descending types, 14 total types and 5 flat types of audiological configuration. In the same study, they reported that patients with a ascending and descending audiogram had better treatment response [10]. There is also the work of Toroslu and his friends reporting that there is no significant difference between audiological configuration and recovery[26]. In our study, we saw that the most common audiological configuration was the flat type (50%). When we looked at the relationship between audiological configuration and healing, a significant relationship was not determined between 2nd month control recovery results and the audiological configuration.

The SSNHL and the tinnitus relationship is another issue where different views are reported. Gordin and colleagues reported that tinnitus was a good prognostic factor, while they saw tinnitus in 62% of the patients [27]. Michiba and colleagues reported that recovery of hearing after SSNHL is often accompanied by improvement of the attendant tinnitus [28]. In our study, 53 of the cases had tinnitus, while 15 did not. In our study, we were unable to identify a significant relationship between tinnitus and recovery.

When we evaluate the SSNHL and vertigo relationship; vertigo is present in 30% to 60% of cases of SSNHL (1, 24). The presence of dizziness or vertigo at time of onset of SSNHL is seen often in more severe cases and is frequently associated with poorer prognosis for hearing recovery [1,24]. In our study, we were unable to identify a significant relationship between vertigo and recovery.

The biggest limitation of our study is its single-centered and retrospective nature. Although there are general common points in treatment and follow-up between clinics in single-center studies in sudden hearing loss, there are also different points. In addition, retrospective studies cannot provide as high evidence as prospective studies. Another limitation is the relatively low number of cases. In the literature, treatment and evaluation approaches for sudden hearing loss are quite diverse. Carrying out multi-centric and prospective studies and increasing the number of samples is important in order to make the findings more meaningful. Although IT steroid application is seen as effective as systemic steroid treatment with minimal side effects, both systemic steroid and intratympanic steroid treatment protocols are quite different. Therefore, a consensus should be provided in the treatment by putting forward the amount of application, application method, steroid preference and side effect profile with controlled studies conducted with larger patient series.

## CONCLUSION

As the degree of hearing loss increased, success decreased and the degree of hearing loss was found to be valuable as a prognostic factor. It was observed that early admission to the hospital and early treatment contributed positively to the recovery. It was observed that systemic steroid treatment was effective in both 5th day and 2nd month controls. With close follow-up, it was observed that salvage intratympanic treatment was effective both at the end of the treatment and at the 2nd month control in the patient group who did not benefit from systemic steroids in the early period.

### Compliance with ethical standards

### Conflict of interest

The authors declare no confict of interest whatsoever arising out of the publication of this manuscript.

### Ethical standards

There is compliance with ethical standard in the research.

### Informed consent

Informed consent was obtained from all individual participants included in the study.

### Human and animal rights

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Financial Support:** No financial support was received from any person, institution or organization in the preparation of this article.

## REFERENCES

1. Chandrasekhar SS, Tsai Do BS, Schwartz SR, Bontempo LJ, Faucett EA, Finestone SA, et al. Clinical Practice Guideline: Sudden Hearing Loss (Update). Otolaryngol Head Neck Surg. 2019;161(1_suppl):S1-S45.
2. Hughes GB, Freedman MA, Haberkamp TJ, Guay ME. Sudden sensorineural hearing loss. Otolaryngol Clin North Am. 1996;29(3):393-405.
3. Marx M, Younes E, Chandrasekhar SS, Ito J, Plontke S, O'Leary S, et al. International consensus (ICON) on treatment of sudden sensorineural hearing loss. Eur Ann Otorhinolaryngol Head Neck Dis. 2018;135(1S):S23-S8.
4. Eisenman D, Arts HA. Effectiveness of treatment for sudden sensorineural hearing loss. Arch Otolaryngol Head Neck Surg. 2000;126(9):1161-4.
5. Leong AC, Fairley JW, Padgham ND. Sudden hearing loss. Clin Otolaryngol. 2007;32(5):391-4.
6. Conlin AE, Parnes LS. Treatment of sudden sensorineural hearing loss: I. A systematic review. Arch Otolaryngol Head Neck Surg. 2007;133(6):573-81.
7. Wilson WR, Byl FM, Laird N. The efficacy of steroids in the treatment of idiopathic sudden hearing loss. A double-blind clinical study. Arch Otolaryngol. 1980;106(12):772-6.
8. Harcourt JP, Lambert A, Wong PY, Patel M, Agarwal K, Golding JF, et al. Long-Term Follow-Up of Intratympanic Methylprednisolone Versus Gentamicin in Patients With Unilateral Meniere's Disease. Otol Neurotol. 2019;40(4):491-6.
9. Haynes DS, O'Malley M, Cohen S, Watford K, Labadie RF. Intratympanic dexamethasone for sudden sensorineural hearing loss after failure of systemic therapy. Laryngoscope. 2007;117(1):3-15.
10. Booth JB. Sudden and fluctuant sensorineural hearing loss. In: Kerr AG, editor. Scott Brown's otolaryngology. 6th. ed. London: Butterworths-Heinemann; 1997;3(17):1-82.
11. Gok U, Kapusuz Z, Sapmaz E, Yildiz M. Ani isitme kaybinda saf ses odyogram tipleri ile prognoz arasindaki iliski. Firat Tip Dergisi. 2007;12(1):13-6.

12. Suzuki H, Furukawa M, Kumagai M, Takahashi E, Matsuura K, Katori Y, et al. Defibrinogenation therapy for idiopathic sudden sensorineural hearing loss in comparison with high-dose steroid therapy. Acta Otolaryngol. 2003;123(1):46-50.
13. Westerlaken BO, de Kleine E, van der Laan B, Albers F. The treatment of idiopathic sudden sensorineural hearing loss using pulse therapy: a prospective, randomized, double-blind clinical trial. Laryngoscope. 2007;117(4):684-90.
14. Grandis JR, Hirsch BE, Wagener MM. Treatment of idiopathic sudden sensorineural hearing loss. Am J Otol. 1993;14(2):183-5.
15. Slattery WH, Fisher LM, Iqbal Z, Liu N. Oral steroid regimens for idiopathic sudden sensorineural hearing loss. Otolaryngol Head Neck Surg. 2005;132(1):5-10.
16. Stachler RJ, Chandrasekhar SS, Archer SM, Rosenfeld RM, Schwartz SR, Barrs DM, et al. Clinical Practice Guideline:Sudden Hearing Loss. Otolaryngology?Head and Neck Surgery. 2012;146(3_suppl):S1-S35.
17. Kordis S, Battelino S. The Role of High Dose Intratympanic Dexamethasone as Salvage Therapy for Idiopathic Sudden Sensorineural Hearing Loss. J Int Adv Otol. 2017;13(3):318-21.
18. Mattox DE, Simmons FB. Natural history of sudden sensorineural hearing loss. Ann Otol Rhinol Laryngol. 1977;86(4 Pt 1):463-80.
19. Byl FM. Seventy-six cases of presumed sudden hearing loss occurring in 1973: prognosis and incidence. Laryngoscope. 1977;87(5 Pt 1):817-25.
20. Alexander TH, Harris JP. Incidence of sudden sensorineural hearing loss. Otol Neurotol. 2013;34(9):1586-9.
21. Ryu IY, Park SH, Park EB, Kim HJ, Kim SH, Yeo SG. Factors Prognostic of Season-Associated Sudden Sensorineural Hearing Loss: A Retrospective Observational Study. J Audiol Otol. 2017;21(1):44-8.
22. Mamak A, Yilmaz S, Cansiz H, Inci E, Guclu E, Derekoylu L. A study of prognostic factors in sudden hearing loss. Ear Nose Throat J. 2005;84(10):641-4.
23. Shaia FT, Sheehy JL. Sudden sensori-neural hearing impairment: a report of 1,220 cases. Laryngoscope. 1976;86(3):389-98.
24. Çelik O, Gök Ü, Yalçın Ş, Yanık H, Hançer A, Kaygusuz S, et al. Ani işitme kayıplı hastalarımızın retrospektif analizi. Kulak Burun Boğaz İhtisas Dergisi. 1997;4:39-42.
25. Niu X, Zhang Y, Zhang Q, Xu X, Han P, Cheng Y, et al. The relationship between hearing loss and vestibular dysfunction in patients with sudden sensorineural hearing loss. Acta Otolaryngol. 2016;136(3):225-31.
26. Li FJ, Wang DY, Wang HY, Wang L, Yang FB, Lan L, et al. Clinical Study on 136 Children with Sudden Sensorineural Hearing Loss. Chin Med J (Engl). 2016;129(8):946-52.
27. Toroslu T, Erdogan H, Caglar O, Guclu O, Derekoy FS. Comparison of Different Treatment Methods for Idiopathic Sudden Sensorineural Hearing Loss. Turk Arch Otorhinolaryngol. 2018;56(4):226-32.
28. Gordin A, Goldenberg D, Golz A, Netzer A, Joachims HZ. Magnesium: a new therapy for idiopathic sudden sensorineural hearing loss. Otol Neurotol. 2002;23(4):447-51.
29. Michiba T, Kitahara T, Hikita-Watanabe N, Fukushima M, Ozono Y, Imai R, et al. Residual tinnitus after the medical treatment of sudden deafness. Auris Nasus Larynx. 2013;40(2):162-6.