RESEARCH ARTICLE / *Araştırma Makalesi*

Effectiveness of Medical Management of the Patients with Sudden Sensorineural Hearing Loss

Ani Sensörinöral İşitme Kaybı Olan Hastalarda Tıbbi Tedavinin Etkinliği

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Abstract

Objective	Management of sudden sensorineural hearing loss still remains unclear in otology. To evaluate our experience medical management of sudden hearing loss with review of the literature.
Materials and Methods	In this study, we performed retrospective chart review including 60 patients presenting sudden sensorineural hearing loss (SSNHL) between 2008-2018 years. We included only patients given medical management, and hyperbaric oxygen was not performed in any patients. Pure tone audiometric measurements investigated before (PTA I) and after treatment at two weeks (PTA II) and three months (PTA III). We also performed cranial MRI on all patients to disclose intracranial pathology if it was present.
Results	The mean age of our cases of was 49.7 years. No certain etiology was detected in all patients in the study. The improvement of hearing loss in our cases was classified according to Siegel's criteria as follows: Type I (3.3%) in 2 patients, Type II (16.7%) in 10 patients, Type III (33.3%) in 20 patients, Type IV (28) in 28 patients (46.7%). Three mean audiometric measurements were compared statistically with each other (PTA I and PTA II: $p < 0.05$; PTA I and III: $p < 0.05$, PTA II and III: $p < 0.05$).
Conclusion	In current study, we found that 60 patients diagnosed as SSNHL and given only medical treatment had positive satisfactory hearing improvement who was observed mainly in that patients with moderate to severe hearing loss and younger ones; however, these results require prospective studies involving a large number of patients.
Keywords	Sudden hearing loss; sensorineural hearing loss; drug therapy management.

Öz

Amaç	*Ani sensörinöral işitme kaybının tedavisi otolojide hala belirsizliğini korumaktadır. Bu çalışmanın amacı ani işitme kaybının tıbbi yönetimi konusundaki deneyimlerimizi literatür eşliğinde değerlendirmektir.*
Gereç ve Yöntemler	*Bu çalışmada 2008-2018 yılları arasında ani sensörinöral işitme kaybı olan 60 hastadan oluşan retrospektif inceleme tablosu yaptık. Sadece tıbbi tedavi verilen hastaları dahil ettik ve hiçbir hastaya hiperbarik oksijen uygulanılmadı. Saf ses odyometrik ölçümler tedaviden önce (PTA I), ve tedaviden sonra ikinci hafta (PTA II) ve üçüncü ayda (PTA III) yapıldı. Eğer varsa intrakranial bir patolojiyi ortaya çıkarmak için tüm hastalara kranial MRI uygulandı.*
Bulgular	*Hastaların ortalama yaşı 49.7 idi. Hastaların hiç birinde etiolojik sebep saptanmadı. Olgularımızın işitme kaybının düzelmesi Siegel'in kriterlerine göre şu şekilde sınıflandırıldı: 2 hastada Tip I (% 3.3), 10 hastada Tip II (% 16.7), 20 hastada Tip III (% 33.3), 28 hastada Tip IV (28) % 46.7). Üç ortalama odyometrik ölçüm birbiriyle istatistiksel olarak karşılaştırıldı (PTA I ve PTA II: $p < 0,05$; PTA I ve III: $p < 0,05$, PTA II ve III: $p < 0,05$).*
Sonuç	*Güncel çalışmamızda ani sensörinöral işitme kaybı teşhis edilen ve sadece medikal tedavi alan 60 hastanın esas olarak orta-şiddetli işitme kaybı olanlarında ve genç olanlarında olumlu tatminkar iyileşme gözlendiğini saptadık; ancak bu sonuçlar çok sayıda hasta içeren prospektif çalışmalara ihtiyaç duymaktadır.*
Anahtar Kelimeler	*Ani işitme kaybı; sensörinöral işitme kaybı; tıbbi tedavi uygulaması.*

INTRODUCTION

Sudden sensorineural hearing loss (SSNHL) which was first described in 1944 is hearing loss of 30 dB or more, over at least three contiguous audiometric frequencies, that develops over a period of up to 3 days.[1,2] The incidence of this otologic emergency is approximately 5-20 out of 100.000 population per year.[3] There are some several factors claimed to be responsible in ethiopathogenesis of sudden hearing loss such as viral infections, vascular disorders, protrombotic diseases, hypercoagulopathy and autoimmune disorders.[4,5] The role of stress and psychiatric disorders remains unclear.

There is still no consensus on the management of this disease due to ethiopathogenesis still remains unclear in most cases. Therefore, different treatment regimens are offered in the management of SSNHL like steroids, vasodilatator agents, antivirals, anticoagulants, diuretics, volume expanders and hyperbaric oxygen therapy. Despite the intense treatment regimens, 45-60% of the cases recover without medication within two weeks after onset. The spontaneous recovery rate is high; up to 30% to 60% of patients may have recovery within two weeks after onset.[5] The primary aim of this retrospective study was assessment of the effectiveness of medical management including systemic corticosteroids using Siegel's criteria for the recovery of SSNHL patients hospitalized in our clinic as a single center experience.[6]

MATERIALS and METHODS

Thirty male and 30 female patients with SSNHL were included in this prognostic cohort study. The ethiopathogenesis, symptoms, therapy regiments and hearing results of 60 patients with SSNHL were retrospectively examined between the years of 2008-2018. Istanbul Medeniyet University Goztepe Training and Research Hospital Local Ethics committee was approved at 24.10.2018 for this retrospective study with an application number of 2018/0383.

The medical treatment consisted of intravenous administration of standard dose prednisolone in all patients. Pentoxifylline (55 patients), enoxaparin sodium (60 patients), B1-B6-B12 vitamin complex (52 patients) and dextran (60 patients) were given in selected patients. The prednisolone dose was 1mg/kg per day initially. The dose was reduced by tapering, and stopped within three weeks. Seventeen patients were also treated with intravenous piracetam (Table 1).

Table 1. The table shows the distribution of medical treatments including Steroid, Nootropil, B vitamins and Trental taken by the patients participating in the study by age groups.

Age		Steroid	Piracetam	B-vitamins	Pentoxifylline
20–40	N	18	9	16	16
	%	100,0%	50%	88,9%	88,9%
41–55	N	22	5	16	19
	%	100,0%	22.7%	72,7%	86,4%
>55	N	20	3	20	20
	%	100,0%	15,0%	100,0%	100,0%
Total	N	60	17	52	55
	%	100%	28,3%	86,7%	91,7%

Oral administration of acyclovir was given in patients who had suspicious viral infection anamnesis, but had not proven with laboratory tests. Additionally, intravenous administration of dimenhydrinate for 3 days in 10 patients who had vertigo. The mean hospitalization time was 8 days in this study.

All patients were hospitalized and given intensive medical therapy. The hearing recovery was evaluated by 3 pure tone audiometry (PTA). First audiometry (PTA I) was performed during the diagnosis, latter (PTA II) 2 weeks after the initial audiometry (PTA I), and the third one (PTA III) at 3 months after the first audiometry (PTA I). The determination of hearing outcomes was based on the four tone average (the arithmetic mean) of thresholds at 0.5 KHz, 1 KHz, 2 KHz and 4 KHz. The hearing improvements were evaluated using Siegel's criteria[6] (Table 2).

All of the data in this study are describe as mean ± stand-

ard deviation. All the statistical analysis were performed in the use of SPSS for windows 15.0 programs. While evaluating numerical values of the pure tone hearing tests performed on patients 3 times; Pearson correlation analysis was applied for statistical analysis. Friedman Test was used to examine the differences between the averages of PTA measurements made at different times. Wilcoxon Signed Rank Test was applied to make post hoc comparisons of the differences between the resulting averages. P value of <0.05 was considered significant.

Table 2. The table shows the distribution of the patients with SSNHL participating in the study by the groups of the Siegel classification, which correlates well with the improvement of hearing loss with increasing patient satisfaction.

Hearing Recovery Type	Recovery Improvement Results
I. Complete Recovery	FH better than 25 dB
II. Partial Recovery	More than 15 dB HG, FH 25-45 dB
III. Slight Recovery	More than 15 dB HG, FH <45 dB
IV. No Recovery	More than 15 dB HG, FH <75 dB

FH: Final Hearing Threshold, HG: Hearing Gain, SSNHL: Sudden Sensorineural Hearing Loss

RESULTS

The mean age of these cases of was 49.7 years. Certain etiology was not found in all patients. Tinnitus (70%) was the most common complaint of the patients initially. Also, 16.7% of the patients had vertigo, and 10% of the patients presented with otalgia. Fifty percent of the SSNHL was encountered on the right ear, and 50% on the left ear. Hypertension (20%), allergy (13%), and diabetes mellitus (6.7%), were detected as additional medical problems in our cases (Table 3).

Table 3. In the table, the distribution of accompanying symptoms such as vertigo, tinnitus and otalgia and accompanying diseases such as HT, DM and allergy in the first application of SSNHL patients participating in the study are shown by age groups.

Age		HT (+)	DM(+)	Allerji(+)	Vertigo (+)	Tinnitus(+)	Otalgia(+)
20–40	N	4	1	5	5	16	5
	%	22,2%	5,6%	22,2%	27,7%	88,9%	27,7%
41-55	N	1	0	3	3	16	0
	%	4,5%	0%	18,2%	13,6%	72,7%	0%
>55	N	7	3	0	2	10	1
	%	35%	15%	0%	10%	50,0%	5%
Total	N	12	4	8	10	42	6
		20,0%	6,7%	13,3%	16,7%	70,0%	10,0%

SSNHL: Sudden Sensorineural Hearing Loss, DM: Diabetes Mellitus, HT: Hypertension.

Pure tone audiometric measurement results of SSNHL patients with vertigo that were included in the study between PTA I, PTA II and PTA III for thresholds at 0.5 kHz and 1 kHz were found to be statistically significant (p<0,05); as p=0,010 and p=0,018, respectively (Table 4).

Table 4. The table shows the comparison of PTA hearing threshold results at 0.5 kHz frequency in SSNHL patients participating in the study with accompanying symptom of vertigo in the first application.

Frequency	Min. (dB)	Max. (dB)	Mean (dB)	Std. Deviation (dB)	Friedman test(p)
PTA I-500Hz	30,00	120,00	77,2727	26,49185	0,001*
PTA II-500Hz	10,00	120,00	66,3636	28,99059	
PTA III-500Hz	0,00	85,00	48,1250	24,63121	
PTA I-500Hz	30,00	120,00	77,2727	26,49185	0,034*
PTA II-500Hz	10,00	120,00	66,3636	28,99059	
PTA I-500Hz	30,00	120,00	77,2727	26,49185	0,007*
PTA III-500Hz	0,00	85,00	48,1250	24,63121	
PTA II-500Hz	10,00	120,00	66,3636	28,99059	0,003*
PTA III-500Hz	0,00	85,00	48,1250	24,63121	

PTA: Pure Tone Audiometry, Hz: Hertz, dB: decibels.
*p<0,05 was considered statistically significant.

On the other hand, pure tone audiometric measurement results of SSNHL patients with vertigo that were included in the study between PTA I, PTA II and PTA III for thresholds at 2 kHz and 4 kHz were not found to be statistically significant (p>0,05); as p=0,409 and p=0,321, respectively. Pure tone audiometric measurement results of SSNHL pa-

tients with vertigo that were included in the study between PTA I, PTA II and PTA III for mean thresholds of 0.5 kHz, 1 kHz, 2 kHz and 4 kHz were not found to be statistically significant (p>0,05; p=0,135) (Table 5).

Table 5. The table shows the comparison of mean PTA hearing threshold results that was the mean of 0.5 kHz, 1.0 kHz, 2.0 kHz and 4.0 kHz frequencies in SSNHL patients participating in the study with accompanying symptom of vertigo in the first application.

Mean frequency	Min. (dB)	Max. (dB)	Mean (dB)	Std. Deviation (dB)	Friedman test(p)
PTA I-mean	50,00	120,00	80,7955	23,85682	0,135
PTA II-mean	57,50	120,00	77,7500	26,15160	
PTA III-mean	40,00	82,50	57,3438	14,32152	

PTA: Pure Tone Audiometry, Hz: Hertz, dB: decibels, SSNHL: Sudden Sensorineural Hearing Loss.

Pure tone audiometric measurement results of SSNHL in 20-40 aged patients group that were included in the study between PTA I, PTA II and PTA III for thresholds at 0.5 kHz, 1 kHz, 2 kHz and 4 kHz were found to be statistically significant (p<0,05); as p=0,001, p=0,001, p=0,034 and p=0,011, respectively. However, hearing recovery at 0,5 kHz and 1 KHz in this (20-40) age group was most remarkable (p=0,001) when it was compared with 2 kHz and 4 kHz frequencies (p=0,034 and p=0,011, respectively) (Table 6).

Pure tone audiometric measurement results of SSNHL in 40-55 and >55 aged patients groups that were included in the study between PTA I, PTA II and PTA III for thresholds at 0.5 kHz, 1 kHz, 2 kHz and 4 kHz were not found to be statistically significant (p>0,05).

The hearing recovery of our cases was classified using Siegel's criteria as follow: Type I in 2 patient (3.3%), Type II in 10 patients (16.7%), Type III in 20 patients (33.3%), Type IV in 28 patients (46.7%). Three mean audiometric

Table 6. The table shows the comparison of mean PTA hearing threshold results at 1.0 kHz fre-quency in SSNHL patients participating in the study by the age groups

Age Intervals	Frequency	Minimum (dB)	Maximum (dB)	Mean(dB)	Std. Deviation (dB)	Friedman test(p)
20-40	PTA I-1kHz	43,00	100,00	76,4444	19,13838	0,001*
	PTA II-1kHz	10,00	75,00	57,7778	21,52195	
	PTA III-1kHz	10,00	70,00	44,3750	21,94758	
41-55	PTA I-1kHz	30,00	120,00	85,0000	31,14482	0,368
	PTA II-1kHz	30,00	120,00	76,3636	27,48553	
	PTA III-1kHz	65,00	120,00	80,0000	22,91288	
>55	PTA I-1kHz	30,00	120,00	86,5000	27,69376	0,109
	PTA II-1kHz	45,00	120,00	87,0000	26,58320	
		30,00	120,00	67,0000	36,67424	

PTA: Pure Tone Audiometry, kHz: kilo Hertz, dB: decibels, SSNHL: Sudden Sensorineural Hearing Loss.
*p<0,05 was considered statistically significant.

Age Intervals	Frequency	Minimum (dB)	Maximum (dB)	Mean(dB)	Std. Deviation (dB)	Friedman test(p)
20-40	PTA I-1kHz	43,00	100,00	76,4444	19,13838	0,005*
	PTA II-1kHz	10,00	75,00	57,7778	21,52195	
41-55	PTA I-1kHz	30,00	120,00	85,0000	31,14482	0,102
	PTA II-1kHz	30,00	120,00	76,3636	27,48553	
>55	PTA I-1kHz	30,00	120,00	86,5000	27,69376	0,480
	PTA II-1kHz	45,00	120,00	87,0000	26,58320	

Age Intervals	Frequency	Minimum (dB)	Maximum (dB)	Mean(dB)	Std. Deviation (dB)	Friedman test(p)
20-40	PTA I-1kHz	43,00	100,00	76,4444	19,13838	0,005*
	PTA III-1kHz	10,00	70,00	44,3750	21,94758	
41-55	PTA I-1kHz	30,00	120,00	85,0000	31,14482	0,317
	PTA III-1kHz	65,00	120,00	80,0000	22,91288	
>55	PTA I-1kHz	30,00	120,00	86,5000	27,69376	0,083
	PTA III-1kHz	30,00	120,00	67,0000	36,67424	

Age Intervals	Frequency	Minimum (dB)	Maximum (dB)	Mean(dB)	Std. Deviation (dB)	Friedman test(p)
20-40	PTA II-1kHz	10,00	75,00	57,7778	21,52195	0,005*
	PTA III-1kHz	10,00	70,00	44,3750	21,94758	
41-55	PTA II-1kHz	30,00	120,00	76,3636	27,48553	0,317
	PTA III-1kHz	65,00	120,00	80,0000	22,91288	
>55	PTA II-1kHz	45,00	120,00	87,0000	26,58320	0,083
	PTA III-1kHz	30,00	120,00	67,0000	36,67424	

measurements were compared statistically with each other (PTA I and PTA II: p<0,05; PTA I and III: p<0,01, PTA II and III: p<0,01). At 2 weeks and after 3 months mean audiometric results were found statistically significant when compared with pretreatment audiometric results. Also, at 2 weeks and after 3 months mean PTA results were detected statistically significant when compared with each other.

DISCUSSION

A cause great expectation, SSNHL is a terrible experience for the patient. The sudden silence, followed, sometimes, by tinnitus and/or vertigo, represents, not only the loss of inner ear function, but also the impairment to the patient's psychological status.[3] Tinnitus (70%) was the most fre-quent complaint of our patients. Additionally, 16.7% of the patients had vertigo, and 10% of the patients referred with otalgia. The incidences are variable, 5 to 20 in 100,000 populations.[7] The mean age of affected patients is between 46 and 49 years, with lowest incidence in the 20 to 30 year age group, and highest in the 50 to 60 year age group.[8] The mean age of our cases of was 49.7 years which was compatible with the literature.

The more common elements of treatment include oral steroid therapy, volume expanders and potentially oral antiviral therapy. Other therapies are used with great frequency, and their potential should not be discounted.[9] Systemic corticotherapy (prednisolone), plasma volume expander (dex-tran) and low molecular weight heparin (enoxaparine) was administrated in all our cases. Also vitamin B1, B6, B12 complex was included in the standard therapy. We excluded patients who had given hyperbaric oxygen therapy to investigate effectiveness of medical management.

Oral or IV applied systemic steroids are standard recommended effective treatment modality, and also the most frequently used management of SSNHL.[10,11] Lan et al. found that systemic corticosteroid therapy were not superior to Pentoxifylline treatment for the management of SSNHL in patients with Diabetes Mellitus.[10] We preferred to apply IV systemic corticotherapy (prednisolone) to all our patients because all of the patients were hospitalized and had vascular access. Corticosteroids also can be given to SSNHL patients as local application via intratympanic injection primarily or as a salvage management successfully.[12]

In this study, we found satisfactory recovery results in younger patients (between 20 to 40 years), especially in PTA thresholds of 0.5 kHz and 1 kHz, using Siegel's criteria. Similarly, hearing improvement in patient with vertigo at PTA thresholds of 0.5 kHz and 1 kHz was favorable but at PTA thresholds of 2 kHz, 4 kHz and mean of 4 thresholds (0.5 kHz, 1 kHz, 2 kHz and 4 kHz) were found unsatisfactory using Siegel's criteria.

Although there have been many clinical reports on the cause, clinical presentation, prognosis, and treatment modality of sudden hearing loss, little attention has been given to the time-dependent course of sudden hearing loss and the time to hearing recovery. The prognostic indicators for hearing recovery in SSNHL were found to be severity of hearing loss, presence of vertigo, time between onset and treatment, the hearing of the other ear, and the audiogram shape.[13,14] In our study; vertigo, severe SSNHL and age greater than 40 years were the poor prognostic factors. However it is difficult to clarify the influence of co-morbid chronic diseases. The improvement rates after our treatment regimens are slightly poorer than the literature.[14-18] This difference can be explained by our strict evaluation; Siegel Criteria. We preferred to use Siegel's Scala for the assessment of hearing recovery because this criteria is well fit with the patients' satisfactory related with hearing improvement. Therefore, the modified forms of this Scala have been used as a hearing improvement chart in the literature.[12,19]

CONCLUSION

Hearing recovery of SSNHL was shown to be continue over 3 months after the hearing loss in this study in patients managed with medical therapy including systemic corticotherapy. However, the further studies are needed with longer follow-up regarding audiometric measurements.

Istanbul Medeniyet University Goztepe Training and Research Hospital Local Ethics committee was approved at 24.10.2018 for this retrospective study with an application number of 2018/0383.

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