

Original Article

Comparing the Efficiencies of Hyperbaric Oxygen Therapy and Intratympanic Steroid Treatment for Sudden Hearing Loss

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OBJECTIVES: To compare the efficiencies of hyperbaric oxygen therapy (HBOT) and intratympanic steroid (ITS) treatment for idiopathic sudden sensorineural hearing loss (ISSHL).

MATERIALS and METHODS: A total of 136 patients who were treated for ISSHL were reviewed from the medical records. All of the patients were given systemic steroid therapy (SST). Among them, 33 patients received HBOT and 36 patients received ITS treatment following SST. The starting time to treatment, risk factors, hearing level, hearing gain (HG), and recovery rate were evaluated from retrospective records.

RESULTS: No substantial change in HG was observed for either the HBOT or ITS treatment cohort ($p > 0.05$). But the time to recovery was higher in the ITS treatment cohort (40%) than in the HBOT cohort (17%). The starting time to ITS treatment was 4 days (range: 1-30) and that to HBOT was 8 days (range: 3-30). There was a significant difference in the starting time to treatment (Mann-Whitney U-test, $p = 0.043$). Also, hearing loss in the HBOT group was significantly higher than in the ITS treatment group. A significant difference was observed before and after ITS treatment ($p < 0.05$).

CONCLUSION: In patients compared with late-onset treatment, ITS may be more effective than HBO after SST failure. It can be used as salvage therapy in patients with ISSHL who are unresponsive to a primary systemic steroid. We observed that HBOT did not improve results when it was started late. Therefore, more studies that include both ITS treatment and HBOT as a nearly treatment option are needed.

KEYWORDS: Sensorineural hearing loss, hyperbaric oxygen therapy, steroid

INTRODUCTION

Idiopathic sudden sensorineural hearing loss (ISSHL) is diagnosed when hearing loss (HL) is > 30 dB for more than 3 days at three different frequencies ^[1]. It is usually unilateral and occurs together with tinnitus and aural fullness. It is not an independent disease and is a clinical sign of many various pathologic conditions. Viral infection, autoimmune syndromes, labyrinthine problems, and metabolic and vascular conditions have all been proposed to cause ISSHL ^[2]. Because of the multifactorial etiologies, there are various therapies, such as vitamin, steroid, anticoagulation, plasma expander, hyperbaric oxygen (HBO), antiviral, and combination therapies.

There have been comparative studies of various combined treatments. In these studies, some combinations have been shown as superior to others ^[3,4]. Although some treatments are more effective than others, only 70% of the patients achieved improved hearing, whereas the remaining 30% did not achieve any improvement ^[3-5].

This study was presented at this study was presented as an oral presentation at the 36th National Congress of Turkish ORL & HNS in Antalya, Turkey, November 5-9, 2014.

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It has been reported that HBO therapy (HBOT) and ITS treatment may be potential salvage therapies in patients with sudden deafness. In our study, we investigated the efficiency of HBOT as salvage treatment of ISSHL in comparison with that of ITS treatment.

MATERIALS AND METHODS

This retrospective study was approved by the local ethics committee and informed consent was obtained from the patients. Inclusion criteria were as follows: (1) SSHL, (2) undetectable cause, (3) absence of fluctuation in HL, (4) ≥30 dB HL, and (5) pretreatment time was ≤30 days. A total of 136 patients (ranging in age from 8 to 87 years), who were treated in otolaryngology clinics for ISSHL, were reviewed from medical records. All of the patients were given systemic steroid therapy (SST): 250 mg intravenous methyl prednisolone (Prednol-L, Mustafa Nevzat, Turkey) followed by 1 mg/kg oral flucortolone (Ultralan, Schering, Germany).

HBOT and ITS treatment were proposed if hearing was unchanged following 3 days of SST. Of the patients who received SST, 36 were subjected to an HBO chamber (100% O₂ and 2.5 atm) for 20 minutes (total of 10 sessions). Another 36 patients were treated with an ITS, i.e., 0.3-0.5 mL of dexamethasone (8 mg/2 mL; Dekort, Deva, Turkey) once a day for 1 week.

The starting time to treatment (<30 days), risk factors, hearing level before and after treatment, hearing gain (HG), and hearing recovery rate (HRR) were evaluated from retrospective records.

The hearing averages at 0.5, 1.0, 2.0, and 4.0 kHz were analyzed. Hearing measurement at the end of the first month after treatment was considered constant.

HG and HRR were calculated using the following equations: $HG = HL_{before} - HL_{after}$ and $HRR = HG / (HL_{before} - HL_{opposite}) \times 100 (\%)^{[3]}$. HL_{before} is the hearing before therapy, HL_{after} is the hearing after therapy, and $HL_{opposite}$ is the hearing of a healthy year.

Statistical Analysis

Statistical analyses were performed using the Statistical Packages for the Social Sciences (SPSS) version 17.0.0 (SPSS Inc., Chicago, IL, USA). Categorical measures are expressed as numbers and percentages, and continuous measurements are expressed as median (range). Categorical measures (sex, risk factors, and vertigo) were analyzed with χ^2 and Fisher's exact test. Because the assumption of a parametric distribution was not met, continuous measurements were made using a Mann-Whitney U-test. A p<0.05 was determined to be statistically significant.

RESULTS

A total of 136 patients treated for ISSHL were reviewed. All of the patients were given SST. Either HBOT or ITS treatment was additionally given to those who did not recover. No significant discrepancies in age and gender were found between groups. No changes in HG were determined between HBOT and ITS treatment cohorts. However, the time to recovery was higher in the ITS treatment cohort (40%) than in the HBOT cohort (17%) (Table 1).

The starting time to ITS treatment was 3 days (range: 1-30) and that of HBOT was 8 days (range: 3-30). A significant difference was found in

Table 1. Patient demographic and clinical data

	ITS treatment group	HBOT group	p
Number of patients	36	33	-
Age (years)*	53 (8-87)	54 (13-82)	0.621
Sex (male/female)	14/22	12/21	0.715
Hearing level before treatment (dB)*	62 (17-120)	89 (28-120)	0.115
Hearing level after treatment (dB)*	31 (2-120)	65 (10-120)	0.075
Time from onset of hearing loss to treatment (days)*	4 (1-30)	8(3-30)	0.043
Hearing gain (dB)	15	9	0.418
Hearing recovery rate (%)	40	17	0.011
p	0.032	0.057	

*Median (range)

ITS: Intratympanic steroid; HBOT: Hyperbaric oxygen therapy

the starting time of treatment (Mann-Whitney U-test, p=0.043). Furthermore, the HL of HBOT group was significantly higher than that of ITS treatment group.

There was a significant difference between before and after ITS treatment (p<0.05). The time to recovery was higher in the ITS treatment cohort than in the HBOT group. However, no significant difference was observed in HG or time to recovery before and after HBOT (p>0.05) (Table 1).

Vertigo was found in four patients in the ITS treatment group and in five patients in the HBOT group. The presence of vertigo did not affect HG, but there was a significant reduction in HRR in patients of the HBOT group who had vertigo (p=0.016).

DISCUSSION

Since the placebo-controlled double-blinded study by Wilson et al. [1] in 1980, SST has been suggested to be the primary treatment for ISSHL. Currently, some patients do not respond to SST. Combined therapies have become popular in recent years for patients who are unresponsive to SST. The efficacy of different combinations including steroid treatments with antivirals, HBO, ITS, and prostaglandin E₁ for ISSHL treatment has been demonstrated in some studies [5-7]. Suzuki et al. [3] showed that SST+ITS treatment was better than SST+HBOT. Fujimura et al. [5] showed the advantage of SST+HBO over SST alone. Suzuki et al. [7] also reported that prostaglandin E₁ and SST were equal in their effectiveness for ISSHL treatment when combined with HBOT. Battaglia et al. [8] reported the best hearing recovery when using combined steroid as a primary option. Also, the substance that increased the permeability of the round window, such as hyaluronic acid, when combined with ITS increased the effect of the ITS treatment. But this effect was not observed on high-frequency ISSHL or severe ISSHL. Vanwijck et al. [9] showed that ITS treatment was efficient after the failure of SST and noted a reduction in the use of hearing aids by >50%. We used SST as the primary treatment of ISSHL; however, this therapy did not work in some cases. We further gave ITS treatment or HBOT to these cases and determined that ITS treatment may be more effective than HBOT following failure of SST. In a retrospective study, Yang et al. [10] compared ITS, HBO, and ITS+HBO with a control group as salvage

treatment in patients with ISSHL following failed SST. They reported no difference between ITS treatment and HBOT groups, but HG and HRR were significantly higher in the ITS+HBO cohort compared with those in the controls^[10]. In a prospective study, Cvorovic et al.^[11] reported a useful effect of HBOT as salvage treatment in patients with ISSHL of cases with <81 dBHL and aged <60 years. Our HBOT group had a median of 89 dB hearing loss, and SST failed in these cases. It is quite possible that these are the most resistant cases to treatment. However, further research is being carried out for the treatment of severe HL, which cannot be treated using steroids. Staecker et al.^[12] in a double-blind, randomized, placebo-controlled study showed the efficacy and safety of intratympanic brimapitide in treating profound HL. Stress kinase inhibitors such as brimapitide seem to be applicable in treating advanced HL. HBOT is the only known method to increase the oxygen level of the perilymphatic fluid. The timing of HBOT is the most important factor in determining its effectiveness. The best results for HBOT were achieved when it was started as early as possible^[13]. In a retrospective study with 19 patients, Muzzi et al.^[14] reported hearing improvement, especially at lower frequencies, when HBOT was used as salvage treatment in patients in whom SST failed. They emphasized that when using HBOT, it should be initiated as soon as possible. Profound deafness and delay in the treatment are negative prognostic factors^[15]. In our study, the HL onset to ITS treatment was 4 days, and that to HBOT was 8 days. Furthermore, HL was worse in patients who underwent HBOT before treatment, although the difference was not statistically significant. These data, together with the different timing of the two therapies in the study, may have influenced the results. Furthermore, this study was designed retrospectively. All these factors constitute the limitations of this study.

CONCLUSION

In conclusion, in patients compared with late-onset treatment, ITS may be more effective than HBO after SST failure. ITS treatment can be used as salvage therapy in patients with ISSHL who are unresponsive to a primary systemic steroid. We observed that HBOT did not improve results when it was started late. Therefore, further studies that include both ITS treatment and HBOT as an early treatment option are needed.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of Baskent University (project no: KA 14/256).

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

Peer-review: Externally peer-reviewed.

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Conflict of Interest: The authors declare that they have no conflict of interest.

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